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DEVELOPMENT OF A MONTHLY MUNICIPAL TECHNOLOGY BULLETIN

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Franklin Institute Research Laboratories

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16. Abstract

Through the joint efforts of the Environmental Protection Agency and the Franklin Institute Research Laboratories, a monthly current-awareness bulletin, MUNICIPAL TECHNOLOGY BULLETIN, has been developed which emphasizes advancements in the field of municipal technology as related to water quality and water pollution control. The purpose of this publication is to inform technical researchers, governmental administrators, and consulting engineers of pertinent information appearing in over 4000 technical journals, both domestic and foreign, currently in circulation. In surveying the literature the following subject areas are explored: wastewater treatment; disposal methods; water reclamation and reuse; water quality requirements; economics of water pollution control; construction equipment and materials; analytical techniques and instrumentation; storm overflows and regulation devices; sewer systems; storm water quality, quantity, and pollution; and, tunneling technology and equipment. The 319 abstracts appearing in the 12 monthly issues are arranged numerically by abstract accession number with corresponding bibliographic citation(s). A subject index providing the necessary access to individual concepts, an author index, and an alphabetical listing of journals referenced in the Bulletin issues are included. (EPA)

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DEVELOPMENT OF A MONTHLY MUNICIPAL TECHNOLOGY BULLETIN

By

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RESEARCH REPORTING SERIES

Research reports of the Office of Research and Monitoring, Environmental Protection Agency, have been grouped into five series. These five broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The five series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies

This report has been assigned to the ENVIRONMENTAL PROTECTION TECHNOLOGY series. This series describes research performed to develop and demonstrate instrumentation, equipment and methodology to repair or prevent environmental degradation from point and non-point sources of pollution. This work provides the new or improved technology required for the control and treatment of pollution sources to meet environmental quality standards.

EPA Review Notice

This report has been reviewed by the Office of Research and Development, Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ABSTRACT

Through the joint efforts of the Environmental Protection Agency and the Franklin Institute Research Laboratories, a monthly current-awareness bulletin, *Municipal Technology Bulletin*, has been developed which emphasizes advancements in the field of municipal technology as related to water quality and water pollution control. The purpose of this publication is to inform technical researchers, governmental administrators, and consulting engineers of pertinent information appearing in over 4000 technical journals, both domestic and foreign, currently in circulation. In surveying the literature the following subject areas are explored: wastewater treatment; disposal methods; water pollution control; construction equipment and materials; analytical techniques and instrumentation; storm overflows and regulation devices; sewer systems; storm water quality, quantity, and pollution; and, tunneling technology and equipment. The 319 abstracts appearing in the 12 monthly issues are arranged numerically by abstract accession number with corresponding bibliographic citation(s). A subject index providing the necessary access to individual concepts, an author index, and an alphabetical listing of journals referenced in the Bulletin issues are included.

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SECTION I

INTRODUCTION

During the past year, the Environmental Protection Agency, Office of Research and Development, Municipal Pollution Control Division, has sponsored the development of a monthly current-awareness publication. This Bulletin, prepared by the Franklin Institute Research Laboratories, Science Information Services Department, served as a "trial" publication with an initial distribution to 100 government and advisory personnel. The number of recipients increased to 468 from additional lists supplied by the Project Officer, Mr. Darwin R. Wright, and through requests from the core list members. During the performance of this task, less than ten recipients were omitted for one of the following reasons: employment termination, lack of interest, or insufficient address (usually foreign delivery).

The format of the monthly Bulletin was designed for ease of reading with references cited to assist the reader in locating additional information if he so desired. Readers also contacted the Project Director, Mrs. Dorothy A. Sandoski, for literature information if their facilities could not provide the articles. The response to this free service, exclusive of GPO-distributed documents and most foreign-language patents, was at first slow, but later increased to an average of two requests per week — an encouraging sign for the use of and reader interest in the Bulletin's contents. It is of interest to note that most recipients inquired as to the cost of this service. Perhaps making know, in print, the fact that this service is free to the readers would invoke more queries.

The contents of each issue were dictated by the quantity and quality of published literature information circulating during a given month's time. Factors influencing the quantity of material published in technical journals and their timeliness included European mail strikes and deliveries, Holidays, and seasonal vacation periods. The quality of literature printed only was dependent on its technical contents. In following the specific criteria used for selecting pertinent articles of technical interest, most of the 200+ weekly screened documents were deemed unacceptable. Comments and constructive criticism by the readers on the contents and format of the Bulletin ranged from "good work" to "abstracts are too long" to "give authors", etc. These remarks were reviewed and appropriate action taken. The most outstanding request was for subject and author indexes. This work was being compiled simultaneously with the issues, but only annual indexes were planned for distribution. The readers were informed of this measure in the October issue of the Bulletin. Most reader comments were stimulated by an introductory letter distributed at the beginning of the Project Period. Perhaps it would be beneficial to distribute these "comment requests" at various intervals during the performance of the project.

In summary, response to the *Municipal Technology Bulletin* has been exceptionally favorable with minor emphasis changes to the present subject areas. It is recommended that this publication be continued with an increase in distribution to reach more local governments and regional planning groups.

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 1

January 1, 1973

SEWER SYSTEMS

As of the end of fiscal year 1970 the rate of coverage of Japan's sewerage systems in terms of drainage area was only 22.8%. Due to the establishment of the 1970 environmental standards and the enforcement of a new City Planning Law, the need for accelerated construction of sewer systems necessitated a third five-year sewerage construction program formulated with an estimated total for the extension of sewer systems starting in fiscal year 1971. The drainage areas of sewer systems is scheduled to reach 38% of the total urban area by the end of this program.

Water Pollution control in Japan, p. 32-33, May 1972.

0001

At present the number of persons being serviced by Stockholm's sewage treatment facilities is more than 900,00 with an estimated one hundred thousand increase by the year 2000. The combined-type sewerage system for the area dates from 1868 and is the mainstay for the district. Since the mid-1950's the sewers have been constructed on the duplicate or separate system and arranged so that the sewage runs under gravity in the direction of the nearest lake. With the need for sewage treatment and the extension of populated limits, intercepting sewers were constructed and the pumping of sewage on a large scale initiated. Today there are approximately 130 sewage pumping stations within the confines of the city.

Vatten, Avlopp Water, Sewage Eau, Egouts, p. 26-27, 1972.

0002

ANALYTICAL TECHNIQUES, SAMPLING, AND INSTRUMENTATION

The Model 1720 Hach Low Range Turbidimeter offers water treatment plants an economical way of providing continuous information about finished water quality. With the lowest of its four ranges, this instrument can measure turbidities as low as 0.04 Formazin Turbidity Unit (FTU). Measurement of turbidity is accomplished by passing a strong beam of light through the sample. Turbidity, present as fine particles, scatters a portion of the light beam which is measured by two photocells submerged in the sample; an indication is obtained on the readout meter. This maintenance-free instrument has a response time to detect a change in turbidity of 30 seconds requiring a sample of 1/4 to 1/2 gallon/minute and measures 32 inches in length by 4 1/8 inches in diameter.

Hach Bulletin 1720-3ED, 1971.

0003

The atomic absorption inhibition titration (AAIT) method was employed to study the simultaneous determination of silicate, phosphate, and sulfate with a single titration. A titration curve with three very distinct shifts in slope of linear segments is obtained. A mechanism in terms of rate processes in the droplets and particles is proposed to interpret the titration curve observed. Mathematical treatment on aspirating loss is developed and shows that such errors are limited to about 1% or less. A set of linear equations allows evaluation of the anion concentrations. The method was successfully applied to the determination of drinking water for silicate and sulfate and to commercial detergent products for phosphate.

Analytical Chemistry, 44(13):2200-2204, November 1972.

0004

TREATMENT METHODS, EQUIPMENT, AND MATERIALS

The application of a freezing-dehydration system for use in treating urban sewage sludge has been tested in Japan. Samples from the Osaka sewage treatment plant were categorized as sludge from the initial precipitation pond, one-hour condensation excess sludge, and mixed sludge. Results show that the precipitation speed of sludge was increased greatly by this freezing-melting method. The precipitation speed of excess and mixed sludge did not change with freezing speeds; however, the initial precipitation pond sampling reacted more effectively under slower speeds. The feasibility of such a treatment system for urban use presently is outlawed due to costs unless natural freeze and an effective use of liquid-gas gasification heat are employed.

Mizu Shori Gijutsu, 13(5):1-6, May 1972.

0005

A high-density polyethylene outfall line, measuring 3 feet in diameter and 3800 feet long, was recently installed as part of a new sewage treatment system serving the Williamsburg, Virginia area. Polyethylene pipe was selected because of its light weight, which permits minimal bottom support, and because of its flexibility, which precludes the possibility of damage to pipe joints during any differential settlement in the soft bottom. The 60-foot-long pipes were butt-fused into 180-foot sections and fitted with a butt-fused stub end and aluminum back up ring. Each section was laid separately except for the last 572 feet or diffuser section which was joined and then laid. This section lies in a basin of 12 feet maximum depth from which 25,000 yards of river bottom were dredged. Approximately 140 feet by 700 feet, the basin is pitched toward the center with the pipe section running along the center. The basin is expected to keep the riser free from blockage due to silt. Free discharge of the effluent flows from the open outfall end.

Civil Engineering, ASCE, 42(10):58-60, October 1972.

0006

TUNNEL TECHNOLOGY

Loading tests to determine the influence of Bernold sheets on the bearing behavior of thin semi-stiff tunnel vaults with large spans have been conducted in Japan. The test piece is a concrete arch section 25 cm thick by 8 meters in length and reinforced by 2 mm-thick Bernold sheets. Under a distributed load of 2.7 tons/cubic meter, no cracks larger than .05 mm were determined. This compared with a broad flanged girder which ruptured under a load smaller than 20 tons/square meter. Results confirm that Bernold sheets have a very high bearing capacity and their joints do not cause any weakness in the structure.

Tunnels and Tunnelling, 4(4):320, July 1972.

0007

The Detroit Metropolitan Water Department's Port Huron tunnel, an 18.3-foot diameter bored tunnel with a foot-thick concrete lining, is scheduled to carry 1.2 billion gallons of water per day. In this project, the hardrock tunneler, designed and manufactured by the Lawrence Division of Ingersoll-Rand Company, Seattle, Washington, bored a record 2060 cubic yards of shale in 19 hours. The 175-ton machine held a steady heading as exemplified by the bored tunnel being within 3.5 inches of true line and grade over the full length of the tunnel. This accuracy was attributed to the tunneler's pilot anchor located immediately behind a pilot drill which extends 10.5 feet ahead of the cutterhead and rotates at approximately 60 rpm while the cutterhead rotated at 7.2 rpm. Working with the pilot anchor, which is attached to a shaft running the full length of the tunneler thus forming the basic structural member of the machine, are rib jacks which thrust up to 1.5 million pounds pressure against the tunnel wall.

Tunnels and Tunnelling, 4(4):317, July 1972.

0008

LEGISLATION

Pursuant to authority granted in Section 39 of the Environmental Protection Act and in the Illinois Pollution Control Board Rules and Regulations the design criteria in the treatment of sewer overflows must meet the following requirements. All system bypasses and overflows that are not absolutely necessary shall be eliminated or alternate facilities provided to insure adequate treatment of the overflows. New combined sewers are prohibited and existing combined sewer systems shall be controlled with overflow regulating devices adjusted to convey the maximum amount of combined flow to the treatment facilities. All infiltration to the sewer system shall be controlled to keep dry weather flow at design limits.

Water Pollution Control Technical Policy 20-24, Illinois Environmental Protection Agency, Sanitary Water Board, revised July 1972.

0009

Under separate legislation, Illinois proposed the following regulations with regards to combined sewers and treatment plant bvpasses: a) installation of new combined sewers is prohibited, except where sufficient retention or treatment capacity is provided; b) excess infiltration into sewers shall be eliminated and maximum practicable flow conveyed to treatment plant bypasses shall be given sufficient treatment to prevent pollution or the violation of applicable water quality standards.

Section 49c, Rule and Regulation No. 602, Illinois Environmental Protection Agency, Sanitary Water Board, *no date given.*

0010

A resolution which contained a time schedule for the city and county of San Francisco to study and develop a master plan for facilities needed to regulate the quality of wastes discharged from its combined sewerage system was amended for an extension of time for the completion of this study program. Under this sewerage master plan, a detailed time schedule for construction of all facilities necessary for compliance with the Board of Supervisor's requirements related to bypassing of mixtures of sewage and storm water from city sewers was prepared.

Resolution No. 70-93, amending Resolution No. 67-64, California Regional Water Quality Control Board, San Francisco Bay Region, November 24, 1970.

0011

HYDROLOGIC ASPECTS

A projected picture of flood control facilities and river conditions in urban areas for 1972 shows that 11.4% of the entire urbanized area in Japan will be endangered by floods at every rain of more than 50 mm hour quantity. According to the investigations of the Ministry of Construction, the percentages of flooded houses in urban and rural areas between 1961 and 1967 show a clear pattern. Except for 1962 when the number of total flooded houses was distributed evenly between the urban and rural areas, the majority of flood damage was found in the cities, the most prominent case being 80% to 20% in 1963. Between 1960 and 1970, the total space of congested city area in Japan increased by 65% with an increase in population of 15 million. This statistic translates to 53.5% of the total population of Japan living in an urban environment. As of 1971, the ratio of reinforced rivers in urban areas averaged 17%, and only 25% of the total urban area had flood prevention measures. An estimated $48.8 million will be needed between 1974 and 1980 in order to remodel all the rivers, drainage, and sewage systems in Japan to accommodate storm runoff.

Kankyo Joho Kagaku, 1(1):33-37, May 1972.

0012

A method for evaluating the probabilities of runoff magnitudes by applying the principle of maximum entropy is suggested. The selection of the most adequate distribution is possible by means of this principle which exploits experimental data available as much as possible without introducing any redundancy. In this study the principle is applied to two different problems: 1) the determination of the distribution with available data on the first three moments; and 2) the selection of the most adequate distribution with a multitude of curves for one and the same accidental magnitude. It is concluded that the principle of maximum entropy should be applied whenever a multitude of distributions are available without experimental data being sufficient or existent.

Meteorologiya i Gidrologiya, (4):61-68, 1972.

0013

Results from measurements of the total runoff coefficient in the Stuttgart-Buesnau sewerage treatment facility indicates that the average quantity of storm water which fails to run off was found to be 0.52 mm (0.85 mm in dry weather and 0.46 mm in moist soil). This quantity results almost exclusively from losses due to soil wetting and in the form of puddle water. After the total runoff coefficient is reduced accordingly with respect to this loss, it becomes a constant value of about 1. Therefore it is surmized that the average storm runoff for an individual rainfall can be calculated from the quantity of the precipitation, less the losses due to wetting and puddle water.

Gas- und Wasserfach, Wasser/Abwasser, 113(7):329-331, July 1972.

0014

A non-linear mathematical model of the urban surface runoff for the calculation of non-stationary runoff in sewer systems is presented. The calculations are based on general, simultaneous differential equations for the surface runoff, i.e. the continuity and the energy equations. The latter can be reduced to an equation for the resistance for stationary, uniform runoff which means that the surface runoff for a given interval can be regarded as quasistationary and locally uniform. The composite watershed is decomposed into surface elements with different successions of the runoff losses caused by them. The specific runoff obtained for the individual surface elements is then superposed to the corresponding surface elements. The input data of the mathematical model are geometrical and hydrological parameters such as wetting conditions, depth and distribution of surface depressions, surface roughness as well as trickling and evaporation characteristics, proportions, and average length and slope of the individual surface element types. Results indicate that variations in rainfall intensity with time are of substantial influence on the magnitude of the runoff peak.

Gas- und Wasserfach, Wasser/Abwasser, 113 (9):430-435, 1972.

0015

General characteristics of rainfall runoff and design criteria of rain overflows, rain overflow basins, purification tanks, and rain catchment basins are described. The maximum contaminant concentration of effluents from a combined sewer system is reached when rinsing of the sewer at a flow rate of 0.5-0.6 m/sec commences. Runoff carries 67% of the BOD$_5$-load and 83% of the unsolved matter during the first half of the rainfall duration. Separate sewer systems carry smaller contaminant loads during rainfall, except for the initial period of runoff. Formulae for the calculation of the sewage runoff with and without rainfall, and for the critical runoff for combined sewer systems are mentioned with regard to criteria for design purposes. Design criteria of various overflows for critical combined water runoff include the following: 1) an overflow canal with one- or two-sided weirs (flow cross-section height of 20 cm) that leads into a 3- to 5-cm deeper sewer channel; 2) an overflow channel having a spring opening in the bottom (approximately 50 cm in length to prevent clogging) through which the excess runoff passes; 3) an overflow channel with horizontal separating plates used for large-capacity sewer systems; and 4) a controlled overflow channel in which a flow height measuring instrument and an electric valve regulate the inflow to the purification plant and stabilize the maximum load of the facility.

Technische Mitteilungen, 65(9):445-450, 1972.

0016

GOVERNMENT-SPONSORED REPORTS

As a result of a national study of the sources and prevention of infiltration and inflow, a Manual of Practices was proposed. The Manual is intended to serve as a guide to local officials in evaluating their construction practices, conducting surveys to determine the extent and location of infiltration and inflow, the making of economic analyses of the cost of excessive infiltration/inflow waters, and instituting corrective action. Excerpts from sewer control legislation are given as well as information on air and exfiltration testing.

EPA/WQO Contract No. 14-12-550, Program No. 11022 EFF, January 1971. 131 p.

0017

An evaluation is provided on the state-of the-art of urban sedimentation control, and a series of research needs in the sedimentation field is cited. In addition, this report includes the "Community Action Guidebook for Soil Erosion and Sediment Control" which describes methods by which local governments can organize, plan, finance, staff, and implement urban sedimentation control programs. Aspects of areawide approaches, legal authority, and public support for sedimentation control are discussed, and an action plan is outlined. While many technical means for controlling sedimentation control problems already exist, new administrative approaches are needed which accommodate the diversity of interests and pressures also associated with urban and suburban development. Establishing control over urban and suburban sedimentation problems was found to require the involvement of several local groups and agencies, and the pattern of involvement varied considerably throughout the nation. A task force management approach was considered to be successful in several instances.

United States Department of the Interior, FWQA Program No. 15030 DTL, May 1970. 35 p.

0018

A program for pollution abatement has been undertaken by the Montgomery County Sanitary Engineering Department in Southwest Ohio to research the effects of infiltration reduction by joint sealing and to study closed circuit television techniques. The study evaluated the effects of remedial repairs to joints by use of pressure grouting of small main line sewers. A minimal measurable amount of quantity flow reduction was attributed to the sewer sealing program. This is to say that infiltration from extraneous storm water, illegal connections, and basement underdrains outweighted that caused by leaky joints to such a degree that reduction due to joint sealing was obscured. The study shows the significance of internal television system as an inspection and maintenance tool.

EPA/WQO Program No. 11020 DHQ, June 1972. 71 p.

0019

PATENTS

A sewage purification system consisting of an aeration tank, two precipitation tanks, an aerobic digestion tank, and a sterilization tank has been patented. One large outer tank is separated into two sections by a partition. One section is segmented further into two sections by double walls which do not cut off the two segments completely. One is the aeration tank, and the excess sludge from this part overflows into the next section when it gets above a certain level; the connecting section is a precipitation tank. When the water level of the supernatant liquid from the second precipitation tank rises above a certain level, it overflows into the sterilization tank. By transferring excess sludge from the aeration tank into its precipitation tank, the sludge concentration of the aeration tank is always maintained at a given level, preventing any lowering of aeration tank functioning.

Japanese Patent Sho 47-12392. Applied March 29, 1967. Issued April 17, 1972.

0020

A patent has been awarded to Rudolf Lautrich for a sewer rain overflow which consists of a channel through which the water passes into the pipe leading to the settling tank. To avoid turbulence at the entrance of the pipe, a connecting piece between the channel and the pipe is tapered. The water not received by the pipe flows over the weir into the overflow channel leading to the draining plant.

German Patent 1,484,876. Applied June 6, 1964. Issued July 6, 1972.

0021

A device for separating sewage solids from sewage fluids has been patented by Claude C. Laval, Jr. The device is characterized by a variably dimensioned orifice for tangentially jetting a stream of fluid into a vortexing chamber supported in an upwardly spaced relationship with an accumulator for descending solids. A flexible closure member is extended across the orifice in the direction of the flow and is provided with a first surface against which fluids passing through the orifice impinge and a second surface against which fluids within the chamber impinge, whereby the effective dimensions of the orifice is varied in response to variations in the flow characteristics of the stream.

United States Patent 3,701,425. Applied October 16, 1970. Issued October 31, 1972.
0022

A patent for a compact, compartmentalized sewage treatment apparatus housed in a single tank has been assigned to James R. O'Connor. Sewage discharged into the apparatus is progressively clarified by anaerobic bacterial decomposition, primary sedimentation and flotation, chemical attack to reduce coliform bacteria and BOD, and secondary sedimentation, flotation and filtration to highly clarify the effluent for discharge into water courses.

United States Patent 3,701,426. Applied November 18, 1971. Issued October 31, 1972.
0023

A sewage disposal unit has been developed which comprises a plurality of flexible sewer pipes adapted to be connected at one end to the mains of a sewage disposal system, flexible plastic septic tank submerged in a body of water adjacent the said sewage mains, and connections between the other ends of said flexible sewer pipes. The mains are connected for discharge throught the plastic pipes into the flexible plastic septic tank which is supported and protected by the surrounding water in which it is submerged.

United States Patent 3,701,428. Applied July 17, 1970. Issued October 31, 1972.
0024

Under this patent street runoff or storm sewage is measured and solids are separated from the liquid first by a grit chamber and screen. Remaining solids are ground by a comminutor, and the fluid is pumped into large temporary storage tanks. The elongated low profile and wide storage tanks are preferably submerged in a body of water, and while sewage is in the tanks, air is continually bubbled upward through the tanks. When excess runoff has ceased, the storm sewage is pumped from the temporary storage tanks and purified before releasing it into a permanent dispersion media, such as a volume of water.

United States Patent 3,674,687. Applied September 19, 1969. Issued July 4, 1972.
0025

A self-contained sewage system has been assigned to Koehler-Dayton of Dayton, Ohio in which a microwave energy source is provided to vaporized the liquid phase of the sewage so that it may be removed from the system and the interval between servicings of the system lengthened. The sewage is transferred from the sewage receiving tank to an evaporating tank for evaporation and, in certain embodiments used in situations where power is not at a premium, a portion of the liquid vaporized from the sewage may be returned to the system for flushing purposes.

United States Patent 3,700,565. Applied April 23, 1970. Issued October 24, 1972.
0026

A process for the treatment of liquid containing biodegradable organic solids, as for example sewage, which combines desirable features of trickling filter and activated sludge systems and includes suitable apparatus has been patented. In this process, a liquid containing biodegradable solids is constantly recirculated from a sump or aerobic lagoon through a trickling filter, and effluent from the trickling filter is mixed with incoming raw sewage with agitation in the sump. The mixture is then retained in quiescent zones before overflow effluent is removed from the sump thus efficiently treating both settleable solids and dissolved solids contained in the sewage.

Canadian Patent 912,716. Applied April 30, 1970. Issued October 13, 1972.
0027

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 2 February 1, 1973

HYDROLOGIC ASPECTS

Modifications of mathematical procedure for the rational formula are suggested to get a more accurate representation of design peak flow rate and flood hydrograph representation. The modified procedure utilizes the basic concept that the rising limb of most flood hydrographs is steeper than the receding limb, implying that water goes into storage faster than it is removed from storage.

Water and Sewage Works, 119(10):92-94, October 1972.

0028

Data on extended heavy rainfall events of small probability, to be used as input data for rainfall-runoff models, were derived from long-term rainfall recordings in northwestern Germany. The approximate values for events of maximum precipitation in that territory were in good accordance with extrema obtained for neighboring countries. Such events have low frequency. Parametric charts for the determination of the daily rainfall for a specified period of time in any locality of the above territory are available with seasonal variations taken into consideration. A statistical approach to the evaluation of the territorial distribution can determine the maximum extension of heavy rainfalls.

Wasser und Boden, 24(10):299-303, 1972.

0029

Precipitation recordings at Munich-Bavariaring over 15 consecutive summer periods were conducted in an attempt to determine the shortest time sequence of heavy rainfall and the frequency of such periods, important factors when dimensioning storm water retention basins. While this 15-year period was too short to allow conclusions on the frequency of such heavy rainfall sequences, it was found that the intervals between rainfall of relatively low intensity are usually shorter than those between high-intensity rains. It is concluded that to avoid overloading storm water retention basins, design criteria for such basins should allow for discharge of storm water loads in less than 8 to 10 hours.

Wasser und Boden, 24(10):303-304, 1972.

0030

SEWER SYSTEMS

Nordrohr type sewer and drain pipes, made of high-density PVC 100 according to DIN 8061 Standards and used in constructing sewer systems, are resistent to most common chemicals; yet pipes with a nominal diameter of 100-200 mm should not be permanently exposed to wastewater with temperatures exceeding 60 C, and those with a diameter of 250-500 mm to temperatures higher than 40 C. Unlike pipes with a diameter of 100-200 mm, those with diameters larger than 250 mm should be laid in a straight line and free of tension. It is possible to combine PVC with pipes made of other materials such as cast iron or stoneware.

Wasser, Luft und Betrieb, 16(10):363-364, 1972.

0031

Plastic pipes to repair or reinforce crumbling sewers were tested in the Dallas system. Over 3000 feet of deteriorating 10-inch concrete sewer line was renewed by pulling continuous lengths of plastic pipe through the existing sewer. Burst tests on the electrically heated butt joints of the pipe section showed that they are as strong as the pipe itself. The economic and technical feasibility of the method demonstrates the practicability of the development since the same method was used in several California cities. Maintenance of sewerage system, including necessary instruments, equipment, operating procedures, and personnel requirements, is also examined.

The American City, 87(10):66-68, October, 1972; 137(12):60, 62, December 1972; 87(11):96, 98, 100, 111, November 1972.
0032

To avoid blocking a busy intersection, a vertical shaft and 75 feet of tunneling were used to connect two sewers with a 32-foot differential in elevation. The vertical shaft consisted of 36-inch concrete pressure pipes with tees at the upper and lower end. A special reducer connects the 36-inch pipe to the 48-inch tee at the lower end. This tee at the base of the shaft permits a slight build-up of water that serves as a liquid cushion at the bottom of the 32-foot drop. An eight-inch riser pipe connected to the vertical shaft at the ends and third point eliminates the possibility of a vacuum developing. The top of the shaft, capped with a concrete bulk-head plug, can be reached by means of a manhole extending to the street surface.

American City, 137(12):28, December 1972.
0033

Pressure drainage for wastewater is steadily attracting more attention in Germany and other countries. It involves a ring arrangement of a discharge pipe network with connecting discharge pipes and sewage conveyor systems for each home. The use of pneumatic conveyor systems lead to the concept of high pressure drainage as opposed to the low pressure drainage determined by the application of hydraulic conveyer systems. High pressure drainage is applied mainly in Hamburg, while low pressure drainage is popular on Neuwerk Island in the North Sea. The pressure conduit system in Hamburg made of low-density PVC 10 pipes receives wastewater from connected houses through 90 mm diameter pipes. Each house is equipped with a pneumatic wastewater delivery unit. The wastewater flow within the collection network, which has inspection and maintenance accesses every 300-400 m and an outlet into a wastewater treatment plant, is supported by compressed air sent through the system at definite intervals. Such pressure conduit sewerage systems require construction costs one-fourth to one-sixth that of conventional sewer systems.

Gas- und Wasserfach, Wasser/Abwasser, 113(10):447-452, 1972.
Wasser und Boden, 24(10):295-299, 1972.
6 refs.
0034

A procedure for the electronic computation of quantities and costs for construction of sewerage systems used for cost estimates, dispositions, and the determination of standing values of existing sewerage systems, has been developed. Materials and job costs, type of soil and trench, groundwater level, pipe diameter, bedding conditions, and type of sheet piling are among the input data. Per-meter prices of materials and individual jobs are computed from the output data contained on three data lists and these unit prices are then integrated for a given sewer section.

Wasser und Boden, 24(10):307-311, 1972.
0035

The main units of treatment of the new Penybont, England sewer system include the main pumping station, the grit extraction and macerating plant, primary sedimentation tanks, the aeration system, secondary sedimentation tanks, and storm water tanks. The ultimate design population will be in the region of 180,000 persons with an anticipated trade flow in the order of 5.5 mgd. The peak design flow is anticipated to amount to approximately 108 mgd, and the storm separation device has been designed to accomodate varying overflow settings as development takes place.

Civil Engineering and Public Works Review, 67(796):1185, November 1972.
0036

TUNNEL TECHNOLOGY

A riverside interceptor sewer, which parallels the Missouri River near the outlet of existing combined sewers, for the collection and treatment of dry-weather wastewater flow was constructed in St. Joseph, Missouri. In this interceptor system the dry-weather flow in the sewers is intercepted and conveyed to a treatment plant. Tunneling was used in the interceptor program in conjunction with the wood box construction method. With this type of construction, a shaft is built at each turning point in the sewer alignment, at each line manhole, and at each diversion structure. A tunneling shield is lowered into a shaft and used to excavate along the sewer alignment. Much of the soil was accreted and contained a variety of materials, including sand, clay, gumbo, trash, loose rock and wood. A portion of the sewer was constructed in sand below the level of the Missouri River, and extensive dewatering was required.

Public Works, 103(11):70-72, 104, November 1972.

0037

The New York City North River Water Pollution Control Project includes 13 miles of tunnels with five tunnel sections, and a 220 mgd treatment plant. Tunneling methods include the conventional shoot and muck, cut and cover, tunnel boring machines (TBMs), working under air, freezing, and combinations of these. Two TBM moles are being used on the Project: one, an 11-foot diameter mole in the south heading of a four mile tunnel; and the other, an 8.5-foot diameter mole in the north heading. The moles cut through the rock with strengths to 30,000 psi. The gage cutter with a 1-inch round bolt carbide insert provides endurance, lasting through 1000 feet. The bolt inserts are placed around the outside of the cutter head. Cutter disks with button carbide inserts are placed around the center of the cutter head. The smooth finish eliminates the need to concrete overbreak areas.

Engineering News Record, 189(17):18-19, October 26, 1972.

0038

A small four wheel drive skid-steer type Uni-loader with a water-cooled diesel engine was used to speed sewer tunnel construction in Lucas County, Ohio. The old fashioned method of tunnel construction was used, the procedure consisting of drilling, shooting, mucking, and installing steel support rims and wooden lagging. Several modifications were made to better equip the Uni-loader for tunneling. A shovel point nose was fabricated onto a conventional bucket since a small loader pushing a standard half-yard bucket into heavy shot rock could be expected to have problems. A special steel box was rigged to the rear of the machine and loaded with 150 pounds of lead for extra counter weight. The air cleaner was replaced with an oil bath cleaner because of the dirty underground conditions. The diesel engine was equipped with a special scrubber-type catalytic muffler designed to reduce the amount of noxious gases emitted. The Uni-loader was used to carry rock, dynamite, drills, steel ribs and laggings, and concrete for the construction of a floor to maintain the pipeline at grade.

Tunnels and Tunneling, 4(6):460, November/December 1972.

0039

A new method and equipment for tunneling through difficult sand and gravel includes the introduction of bentonite to the basic method used in tunneling through soft ground with an excavator shield. The use of the new machine and technique eliminates or reduces the use of compressed air, which can cause bone necrosis in tunnel miners, and also reduces the risk of subsidence. With the tunneling machine, similar to other excavator shields designed for soft tunneling, the cutters revolve in a sealed chamber which is filled with a thixotropic slurry of bentonite clay under pressure. Bentonite holds up the tunnel face, sinking into the gravel for some inches and forming a skin to seal it. One tunnel ring at a time is built up from cast iron segments in the tail of the machine and the machine pushes itself forward by jacking against the completed ring. The development of this method will considerably reduce tunneling costs and also have an important effect on the building of underground railways as well as becoming applicable to tunnels for sewers, water supply, or electric cables. Tunnels can be constructed at relatively shallow depths below buildings or roads without danger according to present experience with the application of this technique.

Surveyor, 140(4189):27, September 22, 1972.

0040

The Mini Tunnel is a complete fully integrated segment built tunneling system replacing sewer trenching in urban areas and accommodating pipes up to 48 inches in diameter. Using thin shell segments, built-in stress inducers keep the structure in compression to tolerate variable soil pressures. Aerohydraulics are used to move the shield through the ground as 120 degree concrete segments are built in the shield tail. Differential pressure steering produces accurate alignment control. The system is competitive with open trench sewer laying at shallow depths. The whole package, including a two-ton crane to handle materials, a tool compressor to drive the shield and gravel injector, and a Mini Mule for underground transportation, with a total weight of six tons, economizes on site-to-site haulage.

Gas World, 176(4599):309, October 14, 1972.

0041

TREATMENT METHODS

Experiments were carried out to determine whether municipal wastewater could be used as an aid in revegetation of strip-mined spoil banks. Municipal wastes are slightly alkaline and highly enriched with dissolved minerals and, therefore, should counteract acidity and low fertility. Spoil material was obtained from a strip mine and treated with sewage effluent. Tree and grass species were also tested for reaction to sludge and effluent treatment. No vegetation survived in the untreated control boxes. In the treated boxes, tree seedlings survived and grass and legume seed germinated. Best overall survival percentages were obtained on boxes which received one inch of effluent and one inch of sludge per week; best germination and growth of grasses and legumes was obtained with two inches of each application per week. Percolate analyses were also run throughout the experiments. The overall results after three years of research indicate that municipal wastewater and sludge can be used to reclaim and revegetate many of the barren bituminous strip-mined spoil banks existing throughout the Appalachian region.

Journal of Forestry, 70(10):612-615, October 1972.

0042

Extensions and implementations are planned for the water supply and sewer system of Moscow to provide for the increasing population and water resource deficit. A 2 increase of water supply is anticipated for the coming years. The daily water supply is projected at 4.4 million cubic meters in 1975, 5.3 million in 1985, and 7 million by 2000, with 30% assigned for industrial and air conditioning purposes. Industries will be forced to focus on developing water recycling methods. A new water reservoir is under construction on the Vazuza River and is expected to provide 1.7 million cubic meters of water daily. To prevent contamination of the surface reservoirs within the metropolitan area, the separate canal networks will be converted into a unitary system handling both the sewage and runoff waters; an aeration system with a daily capacity of one million cubic meters will also be provided.

Gigiyena i Sanitariya, 37(16):16-20, 1972.

0043

The South Eastern Sewerage System for Melbourne, Australia, projected for completion in 1975, will intercept wastewater from Melbourne's eastern, northeastern, and southeastern suburbs and convey it to a new treatment plant. The system will cost $180 million and will provide generally for a population in excess of 1.5 million; when fully developed it will provide for about 3.5 million population. The system consists of four major elements: intercepting and trunk sewers, pumping stations, the purification plant, and an effluent outfall sewer. Designs for pretreatment, primary and secondary treatment, solids treatment and disposal, process control, and auxiliary and power systems and personnel requirements have been developed.

Water and Sewage Works, 119(11):80-89, November 1972.

0044

Wastewater treatment within a pressure pipeline shows promise of producing better than 90% BOD removals, with costs at 40% less than a conventional secondary treatment and reclamation system. The pressure pipe treatment (PPT) system provides both transportation and treatment in the pipeline used to deliver the reclaimed water to the point of reuse. Biological treatment occurs in the pipeline by a modification of the conventional activated sludge process. The introduction of air or pure oxygen in the pipeline maintains the necessary dissolved oxygen for the process. Activated sludge, removed at the upstream end of the pipeline, returns to the downstream end via a sewer. The system is composed of influent headworks, primary sludge separation, an aerobic sludge activator, a wet well, an air compressor, a PPT pipeline, a sludge removal process, final processing, and reclaimed water distribution.

American City, 87(10):84, 86, 90, 93, October 1972.

0045

Effluent from the secondary stage of a municipal sewage treatment plant is amenable to tertiary treatment to fit it for use as a power plant make-up water. The majority of make-up water is used for cooling towers and boiler feed. The secondary treatment stage of the sewage plant is activated sludge. Its effluent is pumped to a Gravier clarifier at a rate of 3000 gpm where phosphates, BOD, and suspended solids are reduced to low values. The incoming flow passes through a flash mixing section where it is mixed with lime and alum at the rate of 2.0 pounds lime and 0.25 pounds alum per 1000 gallons of water.

Power Engineering, 76(11):40-41, November 1972.

0046

Until recently, gravity has been used as the only source of energy for collection and transport of sewage wastewater in Germany thus offering technical solutions for determining construction principles for city sewer networks and hydraulic capacity limitations. In view of high costs for the construction of sewer systems, methods must be developed for better utilization of present capacity. Electronic network plan computation permits the determination of a sewer system's compound effect as a prerequisite to the use of available capacity by suited regulation systems. In the city of Hamburg, such a control system is being realized. As a first step teleprinting rain gauge and teleprinting depth indicators in the sewer have been installed. The most favorable runoff conditions of the system are computed by electronic data processing. Two new methods have been developed to aid improvement, those being pressure drainage and vacuum drainage.

Technische Mitteilungen, 65(9):409-412, September 1972.

0047

The systems operation of an urban sewage treatment plant in Japan involves taking various measurements at each treatment plant and directly sending them to a control room, with data at distant pumps and rivers being sent by telemeters. The control room consists of a monitoring room, a calculator room, and an electric panel console room. The collected data are handled by a computer and the results transmitted directly as control orders to operators, relay panels, sequences for operating pumps, receivers, gates, and valves. Transmitter pumps are operated by telecommunication remote control. Industrial television monitors the conditions of each treatment plant, and the data are recorded generating alarm signals on the operation guide which automatically initiates necessary action. As supplementary apparatus, television and slide displays, an audio system, typewriters, and trend recorders are used.

Kankyo Sozo, 2(10):45-52, October 1972.

0048

MODEL STUDIES

Theoretical models for bio-oxidation using a sheet flow reactor with a fixed biological film similar to that used in a trickling filter were developed. The models assumed plug flow hydraulics and accept numerous assumptions for BOD removal kinetics including: zero order, first order, Michaelis-Menton, and retardant mechanisms. Systems models were constructed incorporating hydraulics, kinetics and film geometry and results arranged topographically into linear epxressions which allow graphical determination of the rate constants from plots of experimental data. Application of the theoretical model is verified using operating data from laboratory studies of municipal sewage, kraft mill effluent, sulfite mill effluent. hard-board mill effluent, and yeast fermentation effluents. BOD concentrations examined varied from 200 to 600 mg; 0.1 pH changes from 4.5 to 9.8 were evaluated. Temperature varied from 15 to 30 C in a series of controlled experiments. Computer programs were developed to accept performance data and to perform the following functions: rearrange units of expression; compute correlation parameters; tabulate all data, graphically array correlations, and to compute model rate constants. Scale-up calculations and verification of the scale-up technique are presented to allow application of laboratory rate constants to determine the prototype rate constant for a specific film geometry.

Water Research, 6(11):1333-1360, November 1972. 3 refs.

0049

Model tests of different types of sewer overflow to define their hydraulic range of application are discussed. These tests were carried out at the Laboratory of Hydraulic and Earthwork Engineering, Technical University of Zurich. Results for separate sewage systems indicate that the usual weir can only be recommended for the range of small base fall of mixed water inflow. A weir with an overfall and a following throttle section can be used in the transition region between a current and flowing water. For the range of big base fall, a leaping weir is recommended. The leaping weir was tested systematically. Using detailed model tests, the common calculation method can be enlarged and improved, especially for soil opening geometry and separate sewers.

Gas, Wasser, Abwasser, 52(10):297-308, 1972. 5 refs.

0050

LEGISLATION

An act, providing for aid to municipalities for water supply, pollution abatement, sewer separation, and engineer planning, first enumerates the procedure required to form a consolidated sewer district and provides that such a body shall be eligible to receive state aid. Requirements for payment and repayment, priorities and limitations, appeal of decisions, and administrative regulations are set forth. The act makes provisions for the method of obtaining grants, priorities to be followed, appeal, and administrative regulations. The act provides for technical and other services to municipalities and details the method of application, form of contracts to be used, eligibility, and limitation.

Vt. Pub. Acts No. 97 (1971).

0051

GOVERNMENT REPORTS

A study was conducted by the American Public Works Association to determine the applicability of a combined sewer overflow regulator which by induced hydraulic conditions separates settleable and floatable solids from the overflow. The study used a hydraulic model to determine swirl concentrator configurations flow patterns, and settleable solid removal efficiency. A mathematical model was also prepared to determine a basis for design. Excellent correlation was found between the two studies. It was found that at flows which simulate American experience a vortex flow pattern was not effective. However, when flows were restricted, a swirl action occurred and settleable solids were concentrated in the outflow to the interceptor in a flow of two to three percent as compared to the quantity of overflow through a central weir and downshaft. The swirl concentrator appears to offer a combined sewer overflow regulator that effectively regulates the flow and improves the quality of the overflow, with few moving parts.

0052

PATENTS

A concentrator system having a large diameter vacuum drum over which an endless filter media is trained has been patented by the Ecodyne Corporation of Chicago, Illinois. The endless screen has an overall length substantially greater than the circumference of the drum and is trained over an idle roller horizontally displaced from the drum. Solid containing liquid slurry or sludge is flowed onto the generally horizontal upper reach of the screen adjacent the roller by horizontal feed. As the screen carries the slurry or sludge away from the feed end, gravity filtering of liquid through the screen takes place. When the screen passes over the drum, vacuum dewatering further reduces the liquid content.

United States Patent 3,704,788. Applied January 11, 1971. Issued December 5, 1972.

0053

A patent has been assigned to Energy Systems, Incorporated of Melbourne, Florida for a waste treatment method of sewage and other liquid wastes in which the final effluent is adaptable for immediate reuse in a water supply system. Raw sewage is screened and the grit removed prior to mixing the sewage into a more uniform slurry. The slurry is processed to remove ammonia, methane, and acid insoluble lipids. The defatted, methane free slurry then has the sludge concentrated for further processing, soil enrichment or burning while the effluent is passed through a series of different processes for removing various harmful or useful materials. This series of processes significantly includes the adapting of chemostats for usage in water treatment. Finally the effluent is prefiltered, passed through a radiation sterilizer, then a polishing filter, for reuse in a water supply system.

Canadian Patent 914,810. Applied September 3, 1969. Issued November 14, 1972.

0054

ANALYTICAL TECHNIQUES, SAMPLING, AN INSTRUMENTATION

Trace amounts of iron (2) were determined by measuring iron (2)-catalyzed light emission from luminol oxidation by oxygen. Iron (2) is the only common metal ion to catalyze the luminol reaction in aqueous solutions in the presence of oxygen alone. The detection limit for this iron is 0.005 micrograms/liter. The minimum detectable quantity is 5 picograms. Response is linear up to 50 micrograms/liter. High concentrations of organic ligands reduce the intensity of light catalyzed by iron but do not affect linearity of response. Excess quantities of copper, manganese, cobalt, chromium, and nickel reduce the light intensity and affect linearity. Chemiluminescence analysis for total iron in natural water samples and standard orchard leaves agreed with values obtained by other methods.

Analytical Chemistry, 44(13):2143-2149, November 1972.

0055

The correlation between ultraviolet absorbance at 254 nm and total organic carbon (TOC) content was determined for a variety of treated and untreated water samples ranging from municipal secondary sewage effluent to raw and processed river water. High correlation coefficients were obtained for water samples which contained sufficient organic carbon to permit accurate TOC determinations. Predictably, systems with low TOC levels yielded lower correlation coefficients. Even with lower correlation coefficients, absorbance measurements can still be used to monitor a process stream for its organic carbon content if interferences from turbidity do not exceed certain limits.

Water Research, 6(10):1173-1180, October 1972.

0057

Nomograms for searching optimum values of the water level, tu, and have weir crest height, pu, for the end of storm overflows in mixed sewer systems have been developed according to the preliminary guidelines of the West Germany Waste Water Association. The nomograms were elaborated for one storm overflow length, seven flow reducer section dimensions, eight reducer section slopes, and one pipe surface roughness. Optimum values of tu and pu, of the load capacity of the reducer section, the reducer diameter, bed slope, and of the storm overflow length are found in the nomogram as a function of the acceptable overload caused by the storm runoff in the outgoing sewer system.

Wasser und Boden, 24(9):312-315, 1972. 3 refs.

0056

Citric and nitrilotriacetic acids were determined at the 1-10,000 ppb levels in aqueous systems ranging from tap water to sewage effluents by using an anion exchange clean-up, derivatization with butanol-HCl and gas chromatography. A variety of metals present, including lead, copper, nickel, zinc, chromium, cadmium, mercury, and iron - all at legal tolerance limits - do not interfere. The two estrified acids separate well on a special gas chromatographic phase. Citric acid can also be separated from nitrilotriaretic acid by ion exchange prior to derivatization.

Journal of Chromatography, 72(2):259-267, October 18, 1972.

0058

A modification of Schilt's method of colorimetric determination of cyanides in sewage was studied. Based on the formation of the colored dicyano-bis(1.10-phenantroline)-iron(II) complex, optimum conditions were established for quantitative separation of cyanides from sewage by distillation, and for the determination of cyanides in the distillate. The effect of neutralizing sewage by complexing with iron salts or by hypochlorite on the course of the determination of cyanides was also examined. A statistical evaluation of the recovery of cyanides showed that the average recovery of cyanides amounts to 105%. Careful selection of distillation conditions enables the quantitative separation of cyanides from complex compounds and the use of the distillate both for colorimetric determinations and for determining cyanides by polarography or by ion-selective electrodes which would be poisoned when used directly in sewage. However, an electrode indicator technique can be used for measuring low levels of cyanide in wastewater from metal plating, steel coking, and other processing installations. The cyanide ion electrode can be used for cyanide determinations down to about 0.3 ppm and will respond to cyanide complexed to some metals, such as zinc or cadmium. To reach lower operating levels and to extend electrode life, a method using the silver sulfide membrane electrode was developed. The minimum detection level becomes about 0.025 ppm. Lower levels were possible with further dilution of an indicator solution, but this was not stable for long periods of time. This method performs well in analysis of both chlorinated wastewater and untreated samples. No prior distillation is necessary for samples.

Chemica Analityczna, 17(4):871-878, 1972.
Analytical Chemistry, 44(13):2227-2230, November 1972.

0059

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SEWER SYSTEMS

The established city of Rochester, England is divided by the River Medway into two drainage areas which have been subjected to periodic flooding. In more recently developed areas, drainage is on the separate system yet during storms excess runoff infiltrates the older parts of the city causing flooding in low-lying areas. To alleviate this constant problem, the city council in 1963 financed a report on the city's surface water drainage system including necessary works to prevent flooding. It was recommended that a separate surface water system supplement or replace the existing sewers. As total redevelopment takes place over the years, the existing partially separate system will be replaced by completely separate sanitary and surface water sewers.

Surveyor, 140(4201):26-29, December 15, 1972.

0060

Development of a sewer surveillance map procedure and a preventive maintenance program based on use of modern sewer cleaning equipment have cut the sewer cleaning call rate from 50 to three calls per week in the northeast sector of Oakland, California. Using city maps for this program, every main is plotted, numbered, and scheduled for cleaning at least once a year. In areas where eucalyptus trees abound, which cause 90 percent of the stoppages, two cleanings per year are scheduled. In addition to mechanical and hydraulic cleaning, the area is chemically treated once a year by a flood and hold method applied one month prior to the scheduled rodding. The control reports coupled with the surveillance maps indicate that maintenance costs average 4.5 cents per foot of sewer.

Public Works, 104(2):82-83, February 1973.

0061

A method of designing long interceptor sewers taking into account rainfall characteristics in assessing their flow-carrying capacity is described. The design procedure proposed involves examination of the effect of undulating storm profiles associated with prolonged nearly-continuous rainfall of moderate intensity as alternatives to the Bilham/Holland type of storm profile with its single peak of high rainfall intensities of relatively short duration. The use of a computer is essential due to the large number of calculations involved with a printout obtainable for each hydrograph with peak values reduced to simulate the effect of storm overflow devices. The final hydrograph printouts can be stored for use as input hydrographs on a final computer run for the sizine of the interceptor sewer using a sub-area technique. Alternatively, the input data file can be prepared to include all existing trunk sewer systems with the new interceptor sewer system and to specify maximum rate of flow values at overflow positions. This avoids the necessity for individual trunk sewer designs for each different storm profile used.

Journal of the Institution of Municipal Engineers, 99(12):338-343, December 1972. 6 refs.

0062

CONSTRUCTION EQUIPMENT AND MATERIALS

The development of a 1300-acre balanced urban community built along the

Missouri River resulted in high flow rate and tight infiltration specifications for the sewer line installed beneath the flood plains. Flexan, a new fiber glass reinforced polyester resin pipe made by Johns-Manville, was used for the sewer line. This flexible conduit is composed of polyester resin and siliceous sand, reinforced with continuous roving glass fibers, is completely non-metallic, and avoids electrolytic or galvanic corrosion. An isophthalic polyester resin gives the pipe its resilience, resistance to moisture, and high dimensional stability. This sand is a functional low-cost filler for wall thickness to meet the internal and external pipe requirements used in gravity transmission of water and wastewater. By using Flextran, with its high flow rate, a reduction in sewer line slope as well as the number of pumping stations was accomplished. Installation was fast and trouble-free due to Flextran's lightweight and longer segment lengths.

Public Works, 104(1):66-67, January 1973.

0063

A $22.8 million sewer outfall laying job including installations of 16,250 feet of pipe with precast caps and cradles, 11,000 feet of H-pilings, and 137,000 feet of timber piling has been performed along Long Island. Trenching the line removed two million yards of sand, silt, and bog material resulting in a 25-foot wide base, 4 to 6 feet below pile cutoff. Dredging and pile driving started from the center permitting a constant shore feed of materials out to the pile and pile barges as well as backfilling in the most effective sequences. The 400 x 40-foot pipelaying barge, stabilized for extra heavy lifting and lowering by external ballast tanks and water-filled compartments within its hull, houses two 60-foot independently operated derrick booms. These booms, mounted on a structural steel base that travels on rails the length of the barge, are equipped with 16-part 1.25-inch lifting cables and powered by a four-drum skagitt hoisting engine. Assembled 100-foot pipe strings are barged alongside the twin derricks, lowered into the trench, and bolted to the preceeding string. Timber piles supporting the pipe strings are driven in the trench by two cranes working from a 340 x 40-foot modified carfloat in an area 260 feet long. To insure accuracy of specifications requiring pipe joints to fall four feet from the center-line of each pile bent, 5-, 6-, and 8-pile bents are positioned with three templates.

Construction Methods and Equipment, 54(12):40-42, December 1972.

0064

Polyvinyl chloride (PVC) pipe has been used to meet tight specifications for the North Table Mountain Water and Sanitation District's sewer system near Denver, Colorado. Replacing vitrified clay pipe specified for all sizes below 10 inches, the PVC pipe, with a rubber ring joint seal, meets exacting specifications of 100 gallons per inch diameter per mile per day and should save the district considerable sewage treatment costs. 19,660 feet of 8-inch and 555 feet of 6-inch of the tough, resilient, and high-impact PVC pipe have been installed. Installation of the lightweight, corrosion-resistant pipe was quick and easy especially in soil of a high water level area.

Water and Sewage Works, 119(12):51, December 1972.

0065

A 22-inch polyethylene pipe lining has been used to renew a 24-inch reinforced concrete gravity sewer main damaged by hydrogen sulfide. The damaged portion of the main extended 754 feet in a straight line and veered at a 45° angle for an additional 96 feet. Added to the cost and inconvenience of replacement were the factors of infiltration of storm water and exfiltration of sewage into the surrounding terrain. Since the flow rate of the mentioned polyethylene pipe was the same as that for the damaged sewer, the polyethylene lining developed by the Du Pont Company was used for repairs. The three pipe sections were pulled by a winch, operating through a manhole on the upgrade of the run, into position at a rate of 30 to 40 feet per minute. The house laterals were then connected to the plastic pipe by inserting 4-inch polyethylene pipe through the old concrete lines and making house connections into the repaired main through the use of remote connector fittings. The entire job afforded a savings of about $10,000.

Public Works, 104(2):64-65, February 1973.

0066

Use of a new coring system has enabled Toronto road authorities to install 2.6 miles of 12- to 48-inch storm sewer lines under existing roadways without disruption to traffic or the existing road surface. The coring system centers around a hydraulic ram and a series of specially developed cutting heads. Technique for coring a service line involves sinking a shaft at the end of the line (no more than 125 feet apart) and excavating to the necessary working depth below the grade of the service. Drill rods are slowly pushed towards the target excavation; expanders widen the hole compressing the soil around the perimeter and preventing collapse; and, subsequent passes are made with a coring tool that cuts the selected diameter shaft, compressing the walls of the tunnel and passing the spoil through the center. Once the full-diameter shaft is completed, the same coring tool is used to insert the lengths of pipe. For this, the sections of pipe are fed to the target excavation and inserted in the hole spigot-end first. An attachment on the drilling tool is used to pull the pipe sections back into the shaft. As each bell end is about to enter the shaft, another pipe section is permanently joined to it and the combined sections are again pulled in. This process is repeated until the pipe reaches the original excavation.

Engineering and Contract Record, 85(12):56-57, December 1972.

0067

MODEL STUDIES

Models for the analysis of urban storm water runoff are evaluated and the following conclusions drawn. In its present state, the Rational Formula is not adaptable to urban runoff conditions and must be modified for this specific use. The Tholin-Keifer model, developed originally for Chicago redevelopment programs, can be adapted to other urban conditions since the dimensioning of the drainage system is based on the most probable form of precipitation distribution with respect to time. Finally, the computerized Narayana-Riley model, operating with regression analysis for the determination of relationships between area characteristics and specific runoff load, constitutes a generally applicable design procedure.

Hidrologiai Kozlony, 52(10):443-445, October 1972. 7 refs.

0068

An infiltration model, based on Horton's diffusion model, has been developed for the determination of runoff in watershed areas. The basic parameters of the computerized model are in principle measurable. As the surface runoff phase as a boundary condition of the infiltration process is considered, event-specific characteristics of the runoff formation are obtained. The initial water content in the ground immediately before rainfall constitutes a determining factor for the relationship of infiltration to surface runoff as it influences the surface retention and the soil infiltration capacities. Watershed areas with fairly homogeneous vegetation are subdivided into wet parts responsible for surface runoff and dry parts with high infiltration capacity for modeling purposes. Applications of this model to areas with abundant precipitation show good agreement with observations.

Wasserwirtschaft-Wassertechnik, 22(12):415-419, 1972. 10 refs.
0069

A mathematical model is shown applicable to the simulation of nonstationary flow processes occurring during the filling of similar flood gate-controlled retention basins. The nonstationary flow process makes it necessary to assume the inflow according to the progress line to be constant during discrete intervals. Partial inflows are determined for the preset geometrical boundary conditions of the flow profiles in assuming a steady state for the individual intervals. Branching and friction losses as well as secondary flow are not considered in the model. Designed to level off flood peaks in a river, this model constitutes a valuable element in the planned process control of flood retention basins.

Wasserwirtschaft-Wassertechnik, 22(11):382-386, 1972. 2 refs.
0070

Studies on sewerage system remodeling plans examine the local load distribution subsystem from the standpoint of river turbidity and the sewage cross section readjustment. Viewing a sewerage cross section at a given time shows the turbidity of the river and offers data for point investment and line investment. In this study, indexes between two points of a model are considered, in order to obtain the time progress of local load distribution. Model formulation which entails a system model and a cut, an equation of state, operating variables, control conditions, and evaluation functions is detailed. It is claimed that this model is applicable not only to a basin with a straight river, but also for basins containing paralleling or ramified river systems.

Preprint, Japanese Society of Civil Engineers, Committee on Sanitation Engineering, 1973. (Presented at the Conference on Sanitation Engineering, 9th, Sendai, Japan, January 29-30, 1973.)
0071

For assisting in the methodology of urban wastewater collection network design, an empirical verification of a sewerline construction cost equation has been devised. On the basis of this verification a nonlinear programming formulation of the sewer network design problem is presented which results in a minimum-cost system. This problem can be solved by the use of the existing commercial computer programs and thus renders it a potentially valuable and practical tool for rigorously incorporating local economic considerations into the design process and for obtaining a minimum cost design. An operational computerized design system is also expected to result in time and manpower savings. This will allow the testing of alternative wastewater collection network and system designs and the investigation of the cost implications of changing any of the inputs to the design process or of varying wastewater collection design standards and criteria.

Journal of the Sanitary Engineering Division, ASCE, 98(SA 6):853-867, December 1972. 21 refs.
0072

GOVERNMENT-SPONSORED REPORTS

A field demonstration of 12 Grinder Pump (GP) Units was performed for a 13-month period in Albany, New York. Continuous operational records were kept by means of an automatic monitoring system and included pressures, water usage, operating time, overflow occurrences, total number of operations, and simultaneous operations. The prototype GP Units registered an undesirably high number of malfunctions; loss of prime by pump, and grease clogging of pressure sensing tube. The new modified GP Units performed exceedingly well for the last seven months of the demonstration and were not afflicted by the aforementioned incidents. There was no visible wear and tear of the mechanical components of the units. The effectiveness of small, non-metallic pipes transporting the macerated wastewater under pressure was successfully demonstrated. Grease accumulation did occur and all results point to a need for careful hydraulic design. Extensive chemical sampling proved that the pressure sewer waste was 100% stronger but contained 50% less contaminants on a gm/capita/day basis. Settleability tests on the pressure sewer waste showed no significant differences over conventional wastewater.

EPA/ORM Report No. EPA-R2-72-091, Project No. 11022 DQI, November 1972. 218 p, 43 refs.

0073

The feasibility and economic effectiveness of a combined wastewater overflow detention basin has been demonstrated. A paved asphalt detention basin with a storage volume of 8.66 acre feet was constructed at Chippewa Falls, Wisconsin to receive overflow from a 90 acre combined sewer area including all of the central business district. The system was designed so that the stored combined sewage could be pumped to the wastewater treatment plant when precipitation subsided. During 1969, due to dry weather, the pond received only sixteen discharges, but completely filled twice and overflow to the river occurred. During 1970, there were 46 discharges and the pond filled once overflowing to the river. Over the two year period, 37.75 million gallons of combined sewage (93.7 percent of the total discharge volume) were withheld from the river for subsequent treatment. There were no observed detrimental effects on treatment plant operation due to the increased intermittent flows from the detention pond. The estimated cost of operating and maintaining the pond and associated facilities was $7,300 per year for the two year period. Capital costs were $6,780 per acre of drainage area including some relief combined sewer and increased size of units at the waste water treatment plant.

EPA/WQO Report No. EPA-R2-72-070, Project No. 11023 FIY, October 1972. 122 p, 4 refs.

0074

This compilation of abstracts summarizes articles from a variety of technical literature and conferences, both domestic and foreign and published from July 1971 through June 1972, primarily related to the problems of urban runoff caused by storm water discharges, combined sewer overflows, and nonsewered urban runoff. All aspects related to this topic fall under the selective areas of: design criteria and construction materials for sewers or apparatus employed in the flow of combined sewage and/or storm runoff; regulation devices for overflow or infiltration from urban runoff of storm water, combined sewage, or highway-salt runoff which can cause water pollution; water quality, legislation, or treatment methods based on problems caused from storm water; and, current tunnel technology and equipment used in the construction of sewer tunnels. The 215 abstracts covering a range of ten sections are arranged numerically by abstract accession number within each category. Each item includes a bibliographic citation, an abstract, and a set of indexing descriptors and identifiers. A subject index appended in this issue provides the necessary access to individual concepts. An author index and a glossary for journal abbreviations are also included.

EPA/ORM Report No. EPA-R2-72-127, Contract No. 68-01-0161, Project No. 11020 HMI, December 1972. 97 p.

0075

Storm rainfall and runoff data were assembled from ten urban basins in the United States ranging in size from 14 acres to 8 square miles. The British RRL method of storm drainage design was applied to the ten basins. The RRL method considers the urban basin to be comprised of the paved area of the basin which is directly connected to the artificial storm drainage system. In three of the basins the RRL procedure was deemed to be appropriate and suitable for the design of a storm drainage system within the normal range of frequency of design rainfall events, from 2- to 20-year events. For greater storms and for certain cases within this frequency range, the RRL method breaks down because runoff coming from the grassed area of the basin is significant. If the basin is highly steep or if the paved area comprises less than 15 percent of the total basin, this breakdown occurs.

EPA/ORM Report No. EPA-R2-72-068, Project No. 11030 FLN, October 1972. 73 p, 26 refs.

0076

This study investigates materials which commonly reside on street surfaces and contribute substantially to urban pollution when washed into receiving waters by storm runoff. Calculations based on a hypothetical but typical United States city indicate that this runoff, similar in many respects to sanitary sewage, from the first hour of a moderate-to-heavy storm discharges considerably more pollutional load than the same city's sanitary sewage during the same period of time. A basis for evaluating the significance of this source of water pollution relative to other pollution sources and information for communities having a broad range of sizes, geographical locales, and public works practices is provided. Information is developed for major land-use areas within the cities, such as residential, commercial, and industrial. Runoff is analyzed for the following pollutants: BOD, COD, total and volatile solids, Kjeldahl nitrogen, nitrates, phosphates, and a range of pesticides and heavy metals.

EPA/ORM Report No. EPA-R2-72-081, Contract No. 14-12-921, Project No. 11034 FUJ, November 1972. 236 p, 71 refs.

0077

PATENTS

A domestic effluent treatment plant, particularly for use with a small number of buildings or as a stand-by for a permanent sewage treatment facility has been patented. The system comprises a unit for biological purification of the effluent, a mixer for introducing a flocculating agent such as $Al_2(SO_4)_3$ into the biologically purified water, a settler for separating sludge, and a separated sludge receiver. The settled sludge receiver is mounted in the lower part of a mobile casing with thermally insulated walls, while the settler is situated above and fixed to the middle of the sludge receiver. The biological purification unit and the flocculant/effluent mixer is mounted above and on either side of the sludge receiver.

Netherlands Patent 7,205,581. Applied April 29, 1971. Issued October 31, 1972.

0078

Floating skimmers slidable on an intake conduit having means to counteract the internal pressure drop normally incident to the intake operation have been patented as a pollution control device. In one embodiment, the cone member has upper vent openings and an internal cylindrical part around the conduit and depending down to near the bottom of the cone. In a second embodiment, the upper cone member is connected pneumatically to the internal chamber of a bellows and the movable part of the bellows is connected structurally to the cone. In both embodiments, the upper cone has a horizontal flange and the lower float has a flat surface extending slightly past the flange and positioned close to the flange in normal use.

United States Patent 3,707,232. Applied October, 20, 1970. Issued December 26, 1972.

0079

TREATMENT METHODS

A combined municipal waste incineration and wastewater treatment plant in Dieppe, France, includes a wastewater treatment unit with a capacity of 8000 m^3/day and an average BOD_5 content of 250 mg/liter. The purification efficiency of the 815 m^3 aeration tank for primary decantation is 81 percent. The effluent from the aeration tank is discharged into a river before secondary decantation and chlorination. The sludge is gradually thickened to 94 percent in the digester kept at a temperature of 29-35° C, and further to 91 percent water content in a thickener. After the water con-tent is reduced to 40-45 percent by drying with steam from the waste incineration plant, the dehydrated sludge is sent to the incinerator. The gases escaping from the sludge during treatment operations are stored for admission into the waste incinerator.

Techniques et Sciences Municipales, 67(10):381-391, October 1972.

0080

As an alternative to the construction of separate drainage systems, the use of storage in trunk and interceptor sewers for regulation of combined sewage flow within the capacity of the interceptor is proposed. The computer-directed system, known as Computer Augmented Treatment and Disposal (CATAD), represents a procedure for maximum utilization of available storage in trunk and interceptor sewers to reduce or completely eliminate overflow. The CATAD system controls comprise a computer-based central facility for automatic control of remote regulator and pumping stations in Seattle, Washington. The installation of equipment at the central station and at 32 remote stations was completed in 1971. All required programming for data acquisition, central station console operation, satellite terminal operation, supervisory commanding, events recording, and data logging is now complete. The system is in continuous operation for system monitoring and is being tested for control in a supervisory mode. Routines for automatic control have been substantially completed and are being integrated systematically with other functions.

Journal of the Sanitary Engineering Division, ASCE, 98(SA 6):951-972, December 1972. 6 refs.

0081

In the past, Japanese sewerage water drainage practices were based primarily on a combined sewage and storm water runoff system. More recently, installation of divided drainage is promoted with secondary sewage treatment being performed by activated sludge, which is less costly but whose result and activity are dependent on biochemical reactions. The biochemical oxygen demand capacity fluctuates largely due to rainfall-runoff relationships though seasonal differences should be considered as well as the change of water quality by rain and toxic material infiltration. In the activated sludge process, the biological phase is complex, and the sludge recycling system further complicates the behavior of the sludge. The structure of a process simulator, the unit calculation program, and a centralized sewage and monitoring and control system are presented. The centralized control system has a capacity for security control, optimum control, and a man-machine communication.

Hitachi Hyoron, 54(10):919-923, 1972. 7 refs.

0082

The City and County of San Francisco in its program for upgrading the quality of wet-weather discharges from its combined sewer system financed the development of a comprehensive program for control of wet-weather flow. The program consisted of design, construction, operation, and evaluation of a demonstration dissolved air flotation facility for overflow treatment. The demonstration facility is located near the principal municipal marina on the northern shoreline of the city. The overall project was divided into three phases extending from 1968 to 1971: 1)preconstruction studies on quantity and quality relationships of combined sewer flows and receiving waters; 2) design and construction of a dissolved air flotation (DAF) facility; and, 3) postconstruction studies on operation and evaluation of the DAF facility and receiving waters. The automated 24 mgd facility is provided with trash racks, short-term sedimentation for removal of settleable solids, dissolved air flotation for removal of flotable materials, and disinfection by chlorination with the effluent discharged to the Bay through a submerged outfall sewer. Monitoring the evaluation programs conducted during the 1970-1971 wet-weather season resulted in minor modifications and additions to the DAF facility to be constructed in time for the 1972-1973 wet-weather season.

Public Works, 104(2):50-54, February 1973.

0083

A screening/dissolved air flotation system is shown as an effective method of reducing pollution caused by combined sewer overflows. Operation data over a two-year period of time indicates the following results. Effluent quality generally comparable to secondary effluent was obtained from the operation of a 5 mgd pilot unit. Ferric chloride (20mg/liter) and a cationic polyelectrolyte (4 mg/liter) provided effective chemical treatment. The screening flotation system provided sufficient detention time for adequate disinfection with chlorine. Capital costs for a 90 mgd facility were estimated at $21,000/mgd of capacity. Operating costs were estimated at $0.0309/thousand gallons or $0.0082/thousand liters.

Journal of the Water Pollution Control Federation, 44(12):2239-2244, December 1972. 6 refs.

0084

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 4 April Fools, 1973

SEWER SYSTEMS

The use of closed-circuit television is being considered in France for the inspection and repair especially of old sewers. Old sewer pipes are rigid making them susceptible to breakage and joint defects and roots cause partial obstruction of the flow cross-section. Flow obstacles result in low flow rates and in increased concrete corrosion hazards due to the formation, from hydrogen sulfide, of sulfuric acid. These problems can be detected and localized in inaccessible sewer pipes through the use of closed-circuit television when the camera is pulled along inside sections between inlets.

Techniques et Sciences Municipales - L'Eau, 67(11):441-444, November 1972.

0085

A digital computer program that incorporates dynamic programming optimization for identifying least-cost design solutions for a given sewer layout is replacing the conventional design resulting from general guidelines which serves adequately but may not be the least expensive functionally acceptable solution. Being an efficient optimization method for sewer design, this program may result in reduced system costs but is even more valuable in providing rapid and inexpensive cost sensitivity and alternative design capability, thus providing the engineer with valuable design and decision information. The results of cost sensitivity analysis of an existing sanitary sewer interceptor system are presented in order to illustrate the value and utility of this type of program and to illuminate the cost significance of commonly used design procedure and criteria.

Journal of the Environmental Engineering Division, ASCE, 99(EE1):35-53, February 1973. 12 refs.

0086

A reinforced plastic mortar interceptor for a regional wastewater treatment plant is part of a planned, staged development project for upgrading the sewage treatment capability of Yuba City, California. The interceptor, which is 1.8 miles long, is connected at its beginning to the new treatment plant under construction and traverses a depth of from 18 feet to 14 feet. The line contains 2950 feet of 42-inch inner diameter gravity pipe, 6175 feet of 36-inch inner diameter gravity pipe, 325 feet of 25-inch inner diameter gravity pipe, and 315 feet of 18-inch inner diameter force main pressure rated at 150 feet per head. The Techite reinforced plastic mortar pipe, manufactured by United Technology Center of Riverside, California, was purchased and trucked to the site in 20 foot lengths.

Water and Sewage Works, 120(1):80-82, January 1973.

0087

To date 116 grants and contracts totaling about 82 million dollars have been awarded in storm and combined sewer pollution control research, development, and demonstration by federal agencies. More than 1300 municipalities with a population of 54 million are served by 55,000 miles of combined sewers with untreated storm-generated combined sewer overflows occurring 3 to 6 percent of the time annually. The need for capital spending to store and/or treat combined sewer overflows can be relieved by reducing or attenuating flow to be treated and/or increasing the effective flow capacity of existing facilities. Some recent EPA-supported projects include: heat shrinkable plastic tubing made of polyolefin-polymeric base hot melt adhesive used in coupling durable, watertight joints to conventional sewer pipes; anti-corrosion coatings of vinyl-vinylidene chloride, vinyl acetate-acrylic, nitrile rubber latex, and various rubbers which may reduce costs by 90 percent over epoxy and plastic liners; refinement of the swirl flow regulator/solids-liquid separator to function efficiently over a wide range of combined sewer overflow rates; a network for remote monitoring of rainfall, flow levels, and quality at selected locations together with a centrally computerized control console for positive regulation of the overflow structures through utilization of storage capacities within the existing sewers to reduce the frequency and volume of overflows; and, certain polymers added to increase the rate of flow of sewage thus increasing the sewer capacity.

Civil Engineering, ASCE, 43(2):57-60, February 1973.

0088

ANALYTICAL TECHNIQUES

The Hitachi Company of Japan has developed a new liquid chromatograph, Model 630-C, using stable electric potential coulometry for analysis of heavy metals. In using this apparatus, when the reaction reaches a given point electrolysis of these metals is completed and analysis is quick. Also, selective reactions are possible using electrolytic potential differences, high sensitivity can be expected, an absolute determination of quantity is possible, calibration curves are not necessary, and the results are not affected by the temperature or the consistency of the liquid. The structure of the apparatus is such that the column solution passes through the electrolytic cell, and the elements in the solution complete electrochemical reaction while passing the cell. If the flow speed is stable, the electric current will show the concentration of the material in the solution. By changing the resin packing of the separation column and the column temperature, the position of analysis may be changed in order to avoid overlapping and 5 to 6 elements can be analyzed in 30 to 40 minutes. This method is applicable to heavy metal ions in saline water or river water, for analysis of liquid waste from industries, and hardness analysis of drinking, industrial, or boiler water.

Hitachi Hyoron, 55(2):21-25, February 1973. 3 refs.

0089

GOVERNMENT-SPONSORED REPORTS

A system study was conducted to determine the technical and economic feasibility of using small storage reservoirs throughout an urban community as a means of storm water pollution control. Facilities were provided to treat the water prior to release or to provide subpotable or potable water for use in the community. A conventional approach to controlling storm water pollution was defined for comparative purposes. Computerized system analysis was used to select the optimal combinations of reservoir locations, type of treatment, and type of reuse on a least cost per day basis. Alternatives were ranked and the optimal practical solution determined considering the constraints. It was determined that the use of local storage and treatment does represent a feasible and economical method for storm water pollution control. Further, the use of the treated water can supply a large portion of the fresh water demands of a typical urban residential community. A demonstration program was planned and subsequently implemented to evaluate erosion and sediment control practices which includes a 3.5 acre lake, evaluation of cleaning and sediment handling methods, and sampling and gaging stations to monitor changes in water quality and hydrology during urban development.

EPA/ORM Report No. EPA-R2-73-139, Contract No. 68-01-0173, Project No. 11030 DNK, January 1973. 266 p, 49 refs.

0090

A study undertaken to search for new approaches to the problem of snow removal and ice control utilized proven techniques of technology transfer in identifying technologies that have not been utilized for deicing purposes. Contracts with specialists and a subsequent session were used to determine strategies for search of computerized data banks. Although several approaches were identified, none are immediately useable. Results of the study indicate that: (1) More information is needed on salt damage to the environment, highway structures, and vehicles in order to perform accurate cost-benefit analyses of alternative approaches. (2) More complete knowledge is needed on the effects of alternate chemical deicers. (3) Pavement heating is an expensive means of removing snow and ice but can be justified in special cases for safety or environmental reasons. (4) Two mechanical devices, snow plow with compressed air and a brush and blower system require further testing and development. (5) Research is required to identify a hydrophobic substance which can be applied to pavement to reduce ice adhesion.

EPA/ORM Report No. EPA-R2-72-125, Contract No. 68-01-0706, Project No. Z-800615, December 1972. 55 p, 65 refs.

0091

MODEL STUDIES

A simple, rational, and effective algorithm developed for use in estimating flows expected in any sewer drainage system is shown over extensive tests to behave well and give reliable and apparently accurate results which compare very favorably with those obtained by other methods. Comparative results indicate that previous techniques of flow estimation are unnecessarily conservative, and further it is to be expected that use of this approach would result in significant economic benefits since decreased design flow means smaller diameter pipes and decreased gradients necessitating less excavation. At the present time, large scale tests are being planned with the dual purpose of testing the accuracy of the flow predicted by the program and to obtain more accurate empirical data on the discharge characteristics of the different types of equipment upon which the program depends.

Building Science, 8(1):23-26, March 1973. 6 refs.

0092

Highway drainage is complicated by the necessity to drain both the pavement and the shoulder in one continuous system. In an attempt to clarify the factors which affect the design of such systems, the Road Research Laboratory began in late 1960 to collect rainfall and runoff data at six sites. Subsequent analysis of some 17 station-years of data under the terms of a research contract between the Road Research Laboratory and the Imperial College of Science and Technology, University of London, has indicated the feasibility of using a conceptual modeling technique for design purposes. The conceptual model which forms the basis of the proposed design method consists of a single linear reservoir having two alternate values of its storage parameter, namely k_1 for periods of rain and k_2 for periods of no rain. Using the total rainfall on only the impervious area as input, the model estimates runoff hydrographs using the equation: $Qt = p[1-\exp(-T/k_1)] + q_o\exp(-T/k_1)$ for periods of rain, and $Qt = q_o\exp(-T/k_2)$ for periods of no rain. q_o and Qt are the rates of runoff at the beginning and end of an interval of duration T respectively, and p is the (constant) rainfall intensity during an interval. The procedure is a step-by-step process, the Qt for one interval becoming q_o for the next interval, the initial value of q_o for the first interval being zero. The time interval used in the present study was two minutes and the units of rainfall intensity and rate of runoff were inches per day. The value of k_1 and k_2 to be used for any given site and rainfall distribution may be estimated from the equations: $\log_e(k_1) = -12.59 + 0.0787 \log_e(\mathrm{IA}) + 1.1245 \log_e(\mathrm{L}) - 0.5315 \log_e(\mathrm{I}_{15})$ and $\log_e(k_2) = -12.51 + 0.1869 \log_e(\mathrm{IA}) + 1.0325 \log_e(\mathrm{L}) + 0.6286 \log_e(\mathrm{P})$, where IA is the impervious area of the site (acres), L is the length of the site (feet), I_{15} is the maximum rainfall intensity of 15 minutes duration (inches/hour), and P is the total rainfall (inches).

Civil Engineering and Public Works Review, 68(799):123, 125-127, 129, February 1973.

0093

A new method of hydraulic network analysis termed as the equivalent diameter method for workable optimum cost solution of pipe sizes of various branches of the network for known nodal pressure heads and water demands incorporating pipe cost function has been formulated. In this method all pipes of the network are replaced by equal lengths of equivalent diameter pipes. Combining the Hazen-Williams equation for pipe flow with the cost function of pipes, a criterion has been developed which when satisfied in each loop of the network would produce the workable optimum solution of the network. A correction factor flow has also been derived which during the iteration process must be added to the flow values to result in the convergence towards the solution. As the theoretical optimum condition will produce zero flow through some members of the network, a workable optimum condition has been considered by fixing a minimum flow through the pipes. A continuous type of solution of the pipe sizes will be obtained by this method and, therefore, computed pipe sizes will be fractional. For practical use, either nearest available commercial pipe sizes may be taken, or the fractional pipe size may be replaced by an equivalent system of two nearest available sizes. The latter method will always produce about two percent more cost than the theoretical least cost.

Water and Water Engineering, 77(923):18-21, January 1973. 3 refs.

0094

The majority of road contracts prepared in the United Kingdom conform to the model contract document for highway works contracts of the Department of the Environment. The standardized way in which drainage information has to be presented is particularly suited to the use of a computer which also reduces repetitive error-prone manual operations. A suite of programs has therefore been written which include KIDD2, BILL, MHOLE, and MHBILL. KIDD2 produces printed output in the form of sewer schedules and gutter schedules, together with punch cards for use as input to BILL. BILL takes as input cards produced from one or more runs of KIDD2 plus any punched manually, and gives a print-out in the form of bill of quantity items. MHOLE uses the same basic card input as KIDD2, yielding printed output in the form of a manhole schedule sorted according to type, together with punched cards for MHBILL. MHBILL accepts cards produced from one or more runs of MHOLE plus any punched manually, and provides print-out in the form of bill of quantity items. The KIDD2 program does the working-up required for sewers and gutter connections. It handles any number of these in the same run by the use of separate subroutines, control being transferred to the appropriate subroutine or returned to the main program by signal cards. The BILL program combines the manual operations of abstracting and billing. It also calculates the average depth and selects the maximum depth for each item. At the same time, it counts the numbers of each kind of gutter connection, and the numbers of junctions of these connections with storm sewers of each size. The purpose of the MHOLE program is to identify each sewer terminal and to calculate and record its name, type, and its depth and volume. The MHBILL program replaces the manual tasks of abstracting and billing, its main function being that of sorting. It uses as input 44-cards output from one or more runs of MHOLE together with any punched manually.

Surveyor, 141(4207):38-41, January 26, 1973.

0095

Aeration basins are widely used in secondary wastewater treatment and can usually be represented by some type of mathematical model. This study, concerned with the representation and interpretation of the kinetic portion of models of aeration basins, uses a somewhat different approach to the modeling of the biological reactions in that it accounts for the individual components of the substrate but treats the microbial population as a homogeneous mass. Validity of the proposed treatment has been demonstrated by experimentation in both batch and continuous laboratory aeration tanks. In view of the need for control and analysis in biological wastewater treatment plants, it is beneficial that the kinetic coefficients of the process model be obtained from such laboratory systems. When introduced into models of the wastewater treatment process together with mixing or dispersion parameters obtained in the plant on the actual equipment, predictions for plant operation and design can be made. The models represent not only steady-state operation but also transient responses caused by changes in plant loading and process upsets.

Journal of the Water Pollution Control Federation, 45(2):292-303, February 1973. 18 refs.

0096

A rational method for the optimization of regional wastewater management systems is developed on the basis of a mathematical model and its subsequent optimization using modern techniques of operations research. However, the economies of scale in interceptor and treatment facility construction and the nonlinearity of hydraulic pipe flow regimes preclude optimization by conventional mathematical programming, since the resulting objective functions are concave. Well proven methods such as linear programming or solution by graph-theoretical analysis are thus inappropriate. Formulation as a fixed-charge problem results in a mixed interger-continuous variable linear programming problem, for which solution algorithms are to date insufficiently proven for general application. Solutions proposed generally exploit the unique structure of the location problem, yet hydraulic transportation networks cannot be treated by such existing methods. An implicit enumeration scheme is proposed to locate the optimum solution utilizing a branch-and bound method as a search strategy. Preliminary results compare favorably to the traditional expedient of sequential technical and economic analysis, whereby a prior selection of feasible solutions is determined on the basis of empirical engineering judgment and subsequently subjected to cost analysis.

IN: Praxis der Umwelthygiene, 5:352-368, 1972. 14 refs. (Presented at the International Congress PRO AQUA-PRO VITA, Basel, Switzerland, 1971.)

0097

CONSTRUCTION EQUIPMENT AND MATERIALS

Nicholas Di Menna & Sons, Inc., the general contractor for sewer and storm line installations at Co-op City, Bronx, New York chose 50 cm diameter, 0.95 cm wall "Raymet" spiral-welded steel pipe and fittings for the force main portion of the sewer network. Due to loose fill and a high water table, creosoted timber piles driven in the trench to an average depth of 13 meters followed by 15 cm of broken stone ballast placed in the trench as a bed for a 28-cm reinforced concrete slab were used in preparing a firm foundation to support the heavy pipe. Before pouring the concrete cradle, the installed pipe was bulkheaded and pressure tested for 30 minutes with water at 8.78 kg/cm^2.

World Construction, 25(12):15, December 1972.

0098

A mixed face excavator burrowing through varying conditions of clay, limestone, and hardpan has advanced beneath the streets of Milwaukee, Wisconsin, opening an average of 28 feet of 12-foot, 1.5-inch diameter sewer tunnel per day. The Mini-John, a 220-hp electro-hydraulic tunneler, is designed to dig both earth and rock with shear planes up to an unconfined compressive strength of 16,000 psi. From within the 19-foot-long protective shield, a toothed-bucket mounted on a rotating boom can be extended seven feet to excavate full face from all levels and angles. Controlled by two 150-ton jacks, the bucket can move 90 degrees and applies a tooth load of 119 tons. The bucket has an 85 degree crowd arc and is rotated 360 degrees by a gear drive that develops 150,000 foot-pounds of torque. A 235-ton hydraulic jack positions the boom radially for full-circle operations. The conveyor, carrying clay and rock upward and back at 200 feet a minute, is powered by a 40-hp electro-hydraulic unit.

Construction Methods and Equipment, 55(2):99, February 1973.

0099

TREATMENT METHODS

The concept of removing phosphorus from wastewater by using a sub-stream within the plant which naturally has phosphorus concentrated considerably above the ambient concentration has been investigated. A continuous laboratory-scale plant was studied, operating under contact stabilization conditions and using an anaerobic holding technique on the return activated sludge; phosphorus was removed from the supernatant of the return sludge stream. The plant was operated with and without the anaerobic holding modification. Both before and after the modification, the organic carbon as measured by COD removal was of the order of 90 percent; after modification of the plant to release the phosphorus from the return sludge stream, phosphorus removals jumped from 10 to 30 percent up to a high of 75 to 90 percent removal. A very slight decrease in sludge activity could be observed due to anaerobic holding, but the very slight reduction in COD removal was more than offset by the increased removal of soluble phosphorus through the supernatant of the return sludge line.

Water Research, 7(142):211-226, January/February 1973. 13 refs.

0100

The construction of the Maebashi Municipal Sewage Treatment Plant was started in 1962 and with gradual expansion and remodeling plans due to increased population, was completed in 1972, except for the sludge incineration process. The plant requires further augmentation and remodeling due to increased total area and population beyond the projected estimations. Standard activated sludge process, convertible to the step method using high speed aeration precipitation, and combined sewer drainage can treat 60,786 m^3/day on dry days, and 165,780 m^3/day during rain. The sewage BOD is 200 mg/liter with an elimination rate of 90 percent; suspended solids are 250 mg/liter with 80 percent elimination. The treatment plant comprises a sedimentation pond, the main pump, and the first settling basin. The surface loads are 44.4 and 121.1 m^3/day with settling times of 0.7 and 0.6 hours for dry and wet days respectively. The aeration tank is divided by porous walls into six chambers, with an air stirring device on one side of the wall. Complete mixing and aeration are completed in the six chambers and the sewage is sent to the final settling basin. The median adjustment wall in this basin helps the precipitation of activated sludge. The settling time is two hours after which sewage goes to a chlorine mixing pond. The sludge goes to the treatment plant, is dehydrated by a centrifugal machine, incinerated, and buried.

Gesuido Kyokai-shi, 10(105):44-49, February 1973.

0101

In the municipal area of Bristol, England, the problem of river pollution due to increased population is being checked by regular improvement and extensions to the sewer system and new sewage pumping and treatment works. The storm water interceptor tunnel, designed to relieve flooding in parts of the city, is used also to convey sewage from the outlying areas. The main pumping station is designed for an ultimate mean dry weather flow of 2.05 m^3/sec and a maximum flow of 12.25 m^3/sec. Providing base-load electrical power to meet the requirements of the sewage treatment plant and main pumping station are four naturally aspirated dual-fuel engines each coupled to a 494kW, 3.3kV, 500 rev/min alternator of the self-regulating type. With the use of waste heat recovery, an overall thermal utilization of 82 percent is achieved at full load. Investigations to assess the future works' load and pumping load indicate that extensions to the generating station would meet the increasing loads. Additional fuel to meet the increased requirements of the extended powerplant installation will be provided by extensions to the works' sludge digestion tanks and gas recovery plant. On completion, sludge gas yield will be sufficient to meet the fuel requirements of the engines when the alternator sets are providing base-load power for the sewage works and incinerator. The dual-fuel operation of the latest engines employs a hydraulically operated gas inlet valve fed from a high-pressure pump via a camshaft-driven distributor.

Gas and Oil Power, 68(775):180-183, Winter 1972.

0102

To meet the demands for water in South West Africa, a system was developed for the reclamation of sewage water and built near the existing water purification works to integrate both installations at low cost. There is no difference in quality between the reclamation water and water from a natural source. The reclaimed water meets in every respect the requirements for potable water of the World Health Organization and is cheaper than natural water in Windhoek. The daily capacity of the water reclamation works is presently 5400 m^3. New additions to the works comprise the following: a blower room housing the main switchboard, incoming flow meter, automatic pH recorder, two recarbonators, compressor, and two 550 ft^3/min blowers; two pH reduction tanks with rotary gas dispensers; an algae flotation tank with rotary surface skimming arms; a domestic detergent removal tank with rotary surface skimming arms; a new chemical house containing solution tanks, dosing equipment, and chemical storage area; a division box for dividing flow to the two existing accelerators and flash mixing tanks; and, six activated carbon filters complete with pumps and pumphouse.

Aqua, (3):14-18, 1972.

0103

Planning and design of a combined sewage and wastewater treatment facility for a 12.7 km^2 urban watershed in Hungary required a maximum yield of 9 m^3/sec as the recipient has a water yield of 0.55 m^3/sec and the dry weather wastewater runoff flows at 0.60 m^3/sec. Mixed sewage water with a maximum yield of 1.5 m/sec will be treated in an activated sludge facility, while the remainder, generated during rainfall periods, will be stored for subsequent purification. Effluents exceeding a yield of 9 m^3/sec will be discharged directly to the receiving body, with the duration of such events not to exceed 3.1 hours per year. The wastewater treatment plant, originally designed for a capacity of 30,000 m^3/day, will reduce the BOD_5 content from 350-500 to 25 mg/liter. Vertical shaft aerators will be used and the aeration time will be 4.3 hours. The sludge obtained will be concentrated from 5 to 30-35 percent by two-stage anaerobic fermentation over 33 days. Centrifugal dehydration with polymer addition, followed by incineration in a rotary furnace, is one option being considered for sludge destruction.

Hidrologiai Kozlony, 52(11):467-476, November 1972.

0104

In the Federal Republic of Germany, 17.5 million cubic meters of wastewater are drained daily to the public sewer, of which 49.8 percent is domestic and commercial, and 36.9 percent industrial wastewater. Prior to discharge, 47.4 percent of the wastewater is treated in biological treatment plants and 28.4 percent undergoes mechanical treatment. Presently, many small communities do not have sewage and/or wastewater treatment; in major cities about one third of the wastewater quantity is treated biologically and about 40 percent treated mechanically. In the future, the sewer system in the rural regions will be completed similarly to that in cities with more than 100,000 inhabitants in which more than 90 percent of the population is connected to sewers. It is projected that from 1969 to 1985 domestic wastewater quantities will jump from 8.7 to 14.7 million m^3/day. This translates to new biological treatment facilities for 19.6 million inhabitants in addition to the mechanical and partly biological treatment plants already planned or in use for 18.1 million people.

Stadtehygiene, 24(1):12-15, 1973.

0105

Plans for an experimental sludge dewatering installation serving at domestic wastewater treatment plants in Hungary are described. Earlier technico-economic considerations controlling the application of dewatering in Hungary are reviewed and reasons justifying the construction of the experimental installation indicated. In this context, the preparatory work preceding the designing of the experimental plant, the considerations governing the selection of the technology, and the problems which the pilot plant is expected to answer are formulated. Under the expansion program of the existing treatment plant at Szekesfehervar an experimental vacuum-drum filter will be added. Information is presented for the plant experiments envisaged, on the procedure of experimentation, and data processing.

Hidrologiai Kozlony, 52(11):489-495, November 1972. 12 refs.

0106

Information on the procedures and results of a series of 14 investigations conducted during 1969 through 1971 at main collector sewage treatment plants and house facilities with digestion tanks are detailed. Sewage was sampled proportionally with the water quantity from the intake at the immersed trickling filters and from the drainage. The analysis was carried out for the consumption of $KMnO_4$, BOD_5, total phosphorus, total nitrogen, and for the oxidized nitrogen in the drain. The relationship between the surface load and the cleaning rate was studied, and in evaluating the data obtained, the pretreatment of the sewage was taken into consideration to prevent misinterpretation. Data indicate that concentration in a drain of equal or less than 25 mg BOD_5/liter can be obtained when the load is equal or less than 10 grams BOD_5/m^2xd. Also if 90 percent of all the values cannot exceed a drain concentration of equal or less than 25 mg BOD_5/liter, then the surface load cannot exceed 3.0 to 4.0 grams BOD_5/m^2xd.

Gas- und Wasserfach, Wasser/Abwasser, 114(1):34-39, 1973. 4 refs.

0107

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 5 May 1, 1973

HYDROLOGIC ASPECTS

Sizeable urban areas have been found to alter all forms of weather in varying degrees. Inadvertent urban modification of precipitation apparently leads to annual precipitation increases of 5 to 30 percent over and immediately downwind of several American cities. These effects also have led to alterations in thunderstorm days with annual increases of 15 to 30 percent near several cities. Frequencies of days with greater than two inches rainfall were increased (due to urban effects) in and downwind of urban complexes by 20 to 40 percent. Runoff in the urban-rain effect areas also has increased by 15 to 20 percent. Groundwater in certain geomorphic areas may also have been affected by these rain increases, since sizeable increases in pollutants in groundwater downwind of St. Louis exhibit some relationship to the urban-produced rain increases. Measurable and economically significant increases in corn yields also have been found downwind of St. Louis and Chicago.

Journal of the Irrigation and Drainage Division, ASCE, 99(IR 1):27-41, March 1973. 10 refs.

0108

SEWER SYSTEMS

A $100 million Little Blue Valley interceptor and wastewater treatment facility will service 225 square miles draining the eastern slopes of Independence, portions of Kansas City, six other towns, and two federal installations in Missouri. With construction already underway on a 9-foot, 7-inch concrete arch sewer, pump station, and interim treatment plant, improved wastewater treatment will be available by 1974 to a major portion of Independence. The projected date of completion for the interceptor and treatment facilities is 1980. The interceptor system ranges in size from 132 inches, or the hydraulic equivalent, at the downstream end to small collectors at the farthest point upstream. Peak flow capacity at the downstream location will be 315.8 mgd with future increase possible through construction of peakflow pumping stations. Eventually, all wastewater generated in the watershed will flow to a plant located near the Missouri River.

Public Works, 104(3):71, March 1973.

0109

MODEL STUDIES

A method to evaluate the global minimum of the nonconvex capital cost function of a hydraulic network based upon a deterministic single load pattern and continuous diameters is presented. Using fundamental graph theory, the problem is decomposed into independent sets of convex functions subject to linear constraints. A standard algorithm is employed to solve the transformed version. Two modifications deviating from previous research facilitate the result: 1) pumping costs are externalized and assumed to be associated with the given hydraulic input; and 2) separate constraints on minimal head losses and flows are substituted for the traditional requirement of minimal admissible diameters. The analysis and cross-sectional area can be expressed as a single-term function of the radius. Since the graph of sewer systems commonly contains no loops, the mathematics and the computational effort are reduced as compared to distribution systems.

Journal of the Hydraulics Division, ASCE, 99(HY 3):431-440, March 1973. 15 refs.

0110

An electric data processing program providing for the computation of sewage load to the main canal during one rainfall and during one year is presented. Parameters taken into consideration included: in- and out-flow times within one settlement area between a sequence of storm water retention tanks; flow detention; annual precipitation and rainfall frequency; intermittent additional water inflow; distribution of sewage water accumulation satisfying local conditions; industrial wastewater inflow dependent on various fluctuations; and the settling effect of the storm water retention tanks as affected by water detention time. In addition, BOD_5 computation is included in this program. Results from evaluation indicate that the total annual main canal sewage load can be reduced by applying a series of intermediate retention tanks, sized with the account of different settling times.

Wasser und Boden, (2):41-43, 1973. 2 refs.

0111

The role of sensitivity analysis in hydrologic modeling has been investigated. It was determined that this analysis will become a more valuable tool as the mathematical structure of the sensitivity becomes more sophisticated. Sensitivity is a measure of the effect of change in one factor on another factor. Sensitivity analysis is potentially useful in all phases of the modeling process: model formulation, model calibration, and model verification. The sensitivity of model parameters should be recognized as a special case of the above general definition. Parametric sensitivity is a vital part of most optimization techniques. However, other facets of sensitivity need to be recognized. The time-dependent nature of sensitivity should be considered in the formulation of hydrologic models. A variety of simplified hydrologic models are used to demonstrate the potential of sensitivity in all phases of the modeling process. The failure to recognize and exploit the potential of sensitivity analysis results primarily from the inadequacy of the mathematical foundations of sensitivity. A comprehensive mathematical framework of sensitivity is provided and additional research needs are identified.

Journal of Hydrology, 18(1):37-53, January 1973. 25 refs.

0112

A simplified model of the overall effect of treatment level on the cost of pollutant capture is presented. The model applies to the application of several conventional methods of air and water pollution control. This particular model uses common power-law functions for the interacting, and competing, factors of economies of scale and diminishing returns. Two variations of the model were developed, one for the relative total cost of state-of-the-art pollutant capture facilities, and another for the marginal or additional cost per unit of pollutant removed in the same facilities. The relative cost of capturing or treating a given amount of pollutant is known to rise with the level of treatment and this simplified model gives an approximate quantitative answer to the question of how much. The cost functions are strongly enough dependent on the level of pollutant capture to emphasize the desirability of the formulation of equally broad, fundamentally-based relationships for the environmental quality benefits to be derived from such capture and treatment activities. The major conclusion is that over realistic ranges of parameter variations, the principle of diminishing returns dominates the system, and the cost per unit of pollutant captured climbs very strongly at higher specified levels of treatment.

Tappi, 56(3):126-130, March 1973.

0113

TUNNEL TECHNOLOGY

Tunneling experience during the last ten years in Austria has proved the advantage of the "New Austrian tunneling method" (NATM) over other methods, particularly in unstable rock. NATM is based on the principle of taking utmost advantage of the capacity of the rock to support itself, by carefully and deliberately controlling the forces in the readjustment process which takes place in the surrounding rock after a cavity has been made, and adapting the chosen support accordingly. Generally two methods of support are carried out. The first is a flexible outer arch designed to stabilize the structure accordingly, and consists of a symmetrically anchored rock arch with surface protection mostly by shotcrete, possibly reinforced by additional ribs and closed by an invert. The behavior of the protective support and the surrounding rock during the readjustment process is controlled by a sophisticated measuring system. The second means of support is an inner arch consisting of concrete, and is generally not carried out before the outer arch has reached equilibrium. Its aim is to establish or increase the safety factors as necessary. The carrying capacity of the outer arch can be decided by the curve characteristic for any given type of rock and primary stress condition. At any intersection between the radial stress and the carrying capacity curve, equilibrium is reached for the respective support resistance. It is a particular feature of the NATM that the intersections always take place at the descending branch of the curve. Should a stiffer type of support be chosen for the outer arch, the intersection with the carrying capacity curve is bound to rise while the safety factor simultaneously decreases. The minimum carrying capacity of the inner arch is decided by the smallest lining thickness that will allow suitable compaction of the concrete. Should a greater radial stress be required, the thickness can be chosen according to required radial stress and the required safety factor. Once the carrying capacity of the outer arch has been established for certain standard sections, the means of strengthening can be chosen and computed accordingly.

Water Power, 25(3):88-93, March 1973.
28 refs.

0114

GOVERNMENT-SPONSORED REPORTS

A microstrainer using a screen with 23 micron apertures reduces the suspended solids of the combined sewer overflow from 50 to 700 mg/l down to 40 to 50 mg/l levels operating at flow-rates of 35 to 45 gpm/ft^2 of submerged screen. The organic matter as measured by COD and TOC was reduced 25 to 40 percent. Coliform concentrations were 0.1 to 9 million cells per 100 ml and no reduction was brought about by Microstraining (C). The coliform concentrations of both overflow and microstrained overflow were reduced by four or more orders of magnitude by disinfection with 5 mg/l chlorine in specially built, high rate, contact chambers of only 2 minutes contact time. The drainage area served by the combined sewer comprises 11.2 acres of a residential area in Philadelphia, Pennsylvania, having an average dry weather sanitary flow of 1000 gph. The overflow rates recorded were generally 100 times, with a maximum 400 times, the average dry weather flow. The extreme importance of very low - 2 minute - residence volume equipment for suspended solids removal and for disinfection in the very high instantaneous rates encountered with storm water is shown. The cost of a microstrainer - special chlorine contact chamber installation is cited as $6,750 per cfs of peak flow rate capacity less land and engineering. On the basis of 2 cfs instantaneous design overflow per acre this is $13,100/acre.

(C) Copyrighted Trade Name - Crane Co.

EPA/ORM Report No. EPA-R2-73-124,
Project No. 11023 FWT, January 1973.
116 p, 22 refs.

0115

An interdisciplinary study is currently in progress at the University of Illinois under a grant from the National Science Foundation RANN Program. Objectives of the study include understanding and modeling the movements and effects of heavy metals (initially lead) in the environment. A model has been constructed which simulates the movements and predicts the accumulation points of lead in a 76-square mile watershed-ecosystem in Champaign County, Illinois. The model includes components of both aquatic and terrestial ecosystems and represents the ecosystem by a network of nodes and branches where the nodes represent the components of the ecosystem in a general sense and the branches indicate possible transport mechanisms between nodes. Results of a two-year simulation using a network of 36 nodes and 121 branches is presented. The model provides a method for the study of pollutant transport and accumulation in ecosystems.

Journal of Environmental Systems, 2(4):339-349, December 1972. 4 refs.
0116

A detailed examination was conducted of ten combined sewer overflow systems within that portion of the Hudson River Basin lying within the Interstate Sanitation District. The work included the identification and study of these combined sewer systems in order to determine their location, physical characteristics, and service areas. The procedure employed included the physical examination of each system's regulators to determine their location, type, dimensions, and condition. A study of available records was made to determine, where possible, trunk line flow, interceptor line design capacity, and characterization of the drainage area served by each regulator which included population and land use. Dry weather and wet weather sampling was also conducted. By-pass loadings for several pollution parameters have been calculated during storm flow conditions based upon this sampling.

EPA/ORM Report No. EPA-R2-73-152, Contract No. 68-01-0055, January 1973. 287 p, 28 refs.
0117

PATENTS

A frustoconical sewage aerator with internal vanes and a circulator has been patented by Ames Gosta Millis and Co., Ltd. The aerator rotates about a vertical shaft, partly dips into the liquid, and centrifuges from its top edge. Above this a concentric annular cover with its outer edge bent downwards rotates with the cone. The opening between the cover and the shaft is covered by a planar or curved plate.

German Patent 1.800,533. Applied October 2, 1968. Issued January 18, 1973.
0118

A patent useful in the biological purification of sewage and effluents has been issued in which selected microorganisms are isolated by taking microorganisms from a natural source such as soil or normal sewage and cultivating them in a media containing specific pollutants, for example detergents, industrial or agricultural chemicals, or animal feed concentrates. The microorganisms are later sporulated, collected, and dried. An inert support, such as bentonite, may be used in the harvesting of the product.

Belgian Patent 786,536. Applied July 20, 1972. Issued November 16, 1972.
0119

A patent has been awarded to E. T. Armstrong for a sewage and wastewater treatment plant which includes primary and secondary settling tanks and a disinfection tank. The plant consists of a primary settling tank with means for introducing the raw effluent, a digester forming the first stage of the biological treatment with means for introducing sludge from the first tank, a second stage of biological treatment, a second settling tank, and a disinfection tank. Disinfection can also be carried out in the pipe system itself by the introduction of oxygen, ozone, and air. This may be followed by chlorination in a contact chamber before final evacuation of the treated effluent. The sludge separated during the successive stages is stabilized in digesters under anaerobic conditions. It is then sent to drying beds, ovens, a fluidized bed reactor, or to a vacuum dehydrating drum.

French Patent 2,126,987. Applied December 21, 1971. Issued October 13, 1972.

0120

An installation for the purification of sewage by means of the activated sludge method has been patented. The system comprises an annular, horizontally disposed circuit adapted to receive the sewage to be purified and two parallel straight portions with two communication sections interconnecting said portions. A surface aerator mounted in one of the communication sections so as to be partially submerged in the sewage received is rotated about a vertical axis to add oxygen to the sewage in the circuit. A partition arranged in the circuit near the surface aerator is closed off on one side of the aerator whereby said surface aerator brings the sewage into circulation within the circuit.

Australian Patent 431,067. Applied June 20, 1968. Issued January 4, 1973.

0121

TREATMENT METHODS AND FACILITIES

A new high service pumping station for the municipally owned water utility of Wichita, Kansas has been designed by consulting engineers Black & Veatch, Inc. of Kansas City, Missouri to replace an 84-year old station now in use. The new facility will not only improve pumping operations, but will also improve the efficiency of the total water system and strengthen the foundation upon which other improvements will be planned and built in the future. Of the many work saving and reliability features designed into the new station, the auxiliary power system to supply energy to seven electrically driven pumps during periods of emergency is the most unusual. The primary source of power for conventional pumping will be two separate generating stations providing service through two 69 kv overhead transmission lines, one of which runs adjacent to and the other directly over the new pumping station site. An underground cable between the high service pumping station and the main cranking diesel generator at the electric company's central powerplant will be constructed for use in the event of a total blackout. Other improvements and refinements designed into the new pumping station include division of the facility into four independent cells to prevent flooding in case of a pipe leak. The centrifugal pumps to be installed will be of the bottom suction, side discharge type connected through a coupling to, and driven by, a constant speed synchronous electric motor. Above the operating floor, the station will have walkways around the top of each of the separate pump rooms. A crane will provide direct access to all pumping units through large open portions in the floor. Hatches and removable slabs will be provided to allow removal of valves and other equipment. Minimum facilities will be provided for maintenance and occasional manual operation of the station.

Public Works, 104(3):94-95, March 1973.

0122

Hillside land disposal spraying is a reliable method of domestic wastewater land disposal which can be used in areas where the soils are not suitable for subsurface disposal or the terrain is too rough for the construction of evaporation-percolation ponds. It is being practiced at approximately 100 camps, subdivisions, and small communities located on foothill and mountain areas throughout California. The goal of the disposal area design is to provide a system which will operate reliably with no surface runoff from the designated area. Design considerations involve: climate and hydrology; geology, soil properties, and topography; treatment capability of soil; application rates; distribution system; public health and reliability requirements; and, operation and maintenance. The principal operational aspects of the spray disposal system are as follows: 1. Records are kept of all sewage bypasses, power failures, effluent runoff, and disinfectant uses. 2. Dosing is intermittent to maintain aerobic conditions and high infiltration rates. 3. Spray areas are alternated to provide rest periods for breakup of biological slimes. 4. No spraying is done on bare or disturbed soil, during rainstorms, or when the soil is saturated. 5. No spraying is done during strong winds if the spray is carried toward nearby human habitations. 6. Spray areas are inspected periodically for clogged sprinklers, dripping nozzles, broken pipes, leaking joints, erosion, and runoff. 7. Spare parts should be maintained for all essential disposal functions to enable speedy repair of broken down equipment.

Journal of the Environmental Engineering Division, ASCE, 99(EE 2):109-121, April 1973. 23 refs.

0123

Completed in 1969, aerated lagoons supplement a conventional activated sludge plant in Itasca, Illinois and this arrangement has avoided several potential problems. The city of 5000 has a present average dry-weather flow in the sewer system of about 0.5 mgd. The activated sludge plant consists of four primary settling tanks, two aeration tanks, a final settling tank, and a sludge disposal system consisting of a holding tank and a vacuum filter for dewatering the sludge. Aeration is provided by the valved tubing arrangement laid transversely to form 290 lines, with the distances between lines increasing with distance from the inlet. With air rising laminarily from the tubing, it creates linear "air screens", separating the lagoons into treatment cells. Four blowers are provided, two rated at 15 hp each to deliver 230 cfm of air at 10 psi, and two rated at 5 hp each to deliver 80 cfm at 9 psi. These are used alternately as 20-hp pairs furnishing 310 cfm. The lagoons were sized to accept a daily BOD loading of 562 pounds. The sides are sloped on a ratio of 1 to 4.17. The retention period at design average flow is 1.9 days.

Public Works, 104(3):97-98, March 1973.

0124

Recently developed storm water retention tanks to prevent main canal overload through polluted water have a bottom discharge, one or several overload outlets, and whose efficiency depends on their position in the sewer system. Criteria involved in their design include overflow frequency and quantity, the amount of discharged mud into the main canal, and dirt conveyed for clarification. Other factors include the average annual dirt freight, the frequency and extent by which this average is exceeded, and the effect of removed undissolved matter, oxygen-consuming organic matter, and nitrogen and phosphorus-containing nutrients. It is suggested that maximum inflow and minimum detention time factors should be used in the sizing of storm water retention tanks for sewer systems having preliminary discharge facilities and with flow durations exceeding 15 minutes.

Wasserwirtschaft, 63(2):42-46, February 1973. 6 refs.

0125

CONSTRUCTION EQUIPMENT AND MATERIALS

Land drainage in the United Kingdom is conventionally carried out using short lengths of clayware pipe, water entry to the system being via the gap between individual pipes. Since 1965 plastic drain pipes, of both smooth and corrugated construction, have been gradually introduced, in which the water enters through holes or perforations in the pipe wall. Hydraulic design data for the new product was lacking because of the unusual types of roughness involved. Laboratory tests were carried out and plotted in the conventional form of friction factor against Reynolds' number. These graphs give information on flow in the laminar region and on the different types of change to transitional flow which may occur. More practically, the tests show that the pipes currently available can be divided into three broad categories based on the type of roughness.

Institution of Civil Engineers, Proceedings, 55(Part 2):273-284, March 1973. 17 refs.

0126

A Drott Model 40YR Cruz-Air hydraulic backhoe, equipped with two interchangeable buckets, a 60-inch bucket, and a Drott 4-in-1 bucket reduced project costs, cut machine rental expenditures, and saved time on various assignments in Barren County, Wisconsin. The Cruz-Air is used in digging test holes for sand and gravel deposits as well as trenching, placing pipes, and backfilling on storm sewer tasks. It can dig and load back-run gravel and sand, lift and place pilings and timbers, and prepare final grades for curbs, gutters, or sidewalks with accuracy within 1/2 inch. This machine has replaced a tractor backhoe, a crawler crane, and a front-end loader.

Public Works, 104(4):95-96, April 1973.

0127

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

A spontaneous mutant of *Aeromonas hydrophila*, a species which is characteristic of the effluent-surface water biotype and is fairly sensitive to toxic substances, has been examined as a method for testing pollutant toxicity to bacterial organisms. In the investigation, mutant growth inhibition by the pollutant in BOD dilution water containing 10^{-5} percent vitamin-free hydrolyzed casein served as a measure of toxicity. A culture of the mutant in the treated BOD dilution water served as a control. Investigations of samples for toxicity are possible due to the specific properties of the mutant.

Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, Abteilung 1: Originale, 156(6):545-550, 1973.

0128

The Olivetti P 602/MLU Network Analysis System, a self-contained printing computer capable of storing both numerical data and programs, is currently solving problems for the Bureau of Environmental Engineering in Arkansas. Application for this computer is found in determining correct flow and head loss for pipes in a water network by performing the Hardy-Cross flow distribution balancing process. The system permits municipal water departments to evaluate the adequacy of a public water system prior to its construction and locate deficiencies in pipe networks which are already constructed. The balancing process of the flow distribution is completely automatic. The P 602/MLU system processes all data unattended. Upon convergence of the process to a pre-determined constant, the corrected flow and head loss are printed for every pipe in every loop. The balancing process will continue automatically without the need to re-enter any data. The network analysis system costs $6675 or it can be leased for less than $160 per month.

Water and Sewage Works, 120(3):65, March 1973.

0129

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SEWER SYSTEMS

The size and investments required for urban and rural sewer system installation and/or expansion in Poland have been announced after statistics of the 1965-1970 five-year plan were tabulated. Data for the 1975-1985 period in terms of sewer length per inhabitant as related to the size of the settlement population are projected. Investment requirements are broken down over three periods, including 1970-1975, 1976-1980, and 1981-1985, according to pipeline length requirements and pump over costs - about 10 percent of that for sewage network installation. Theoretically, sewage system planning and development constitutes an integral part of their housing development and the sewage system pipeline length should accommodate all who receive public water.

Gaz, Woda i Technika Sanitarna, 47(1):20-21, 1973.
0130

Through the sewers of Paris, effluents are channeled by five gravitational collectors, with slopes of 0.20m/km, into waste treatment plants located in the north and northwest from Paris. When necessary, the collectors are conducted underneath the Seine bed by means of siphons. High storm water runoff loads occurring in the mixed sewage system are leveled off by retention basins. The sewage system also accommodates water supply pipes, telephone and other communication lines.

Travaux, (455):40-45, February 1973.
Travaux, (455):46-50, February 1973.
0131

All communities along the presently polluted Traisen River from Wilhelmsburg to the Danube in Austria, have voted to build a new sewage treatment plant and a trunk sewer, since the existing facilities at St. Polten are inadequate and the community desires to make the Traisen a bathing river again. The sewer, now under construction, passes the waterworks areas using wells 6 to 7 meters deep with part below groundwater level and discharges at a new sewage treatment plant on the Danube. The sewer pipe, egg-shaped, with a maximum cross sectional area of 2.4 x 2.4 meters, is being built of pre-fabricated sections with specially sealed joints using putty with a tin strip to ensure perfect tightness.

Gas/Wasser/Waerme, 27(2):31-33, 1973.
0132

A specially designed inflatable plug, used for bypassing when sewer repairs are required, eliminates flooding and the ensuing cleanup problems. The plugs, known as Muni-Balls, are manufactured by Cherne Industrial, Inc. of Edina, Minnesota and come in sizes from 6 to 53 inches in diameter. Made of an elastic compound and molded on high tensile strength aluminum castings, they include a removable plug in the center ranging from 1 to 4 inches in diameter.

The American City, 88(4):22, April 1973.
0133

Plastic pipes are being used in the construction of sanitary sewers for a California area having a steep hillside terrain with rock outcroppings. After much construction bidding and rebidding for the 70,000 feet of pipeline, the Otay Municipal Water District permitted the use of plastic pipes. These pipes have demonstrated the following advantages: low material cost; long, lightweight pipe lengths, permitting easy handling, storage, and laying; pipe flexibility allowing maximum curvatures; fast, positive air pressure testing; narrow trench digging; and, simpler manhole construction with longer spacing and compatibility with plastic laterals and saddles. Prior to use of such pipes, specific laboratory tests were performed. Tests consisted of subjecting pipe specimens to extreme conditions - far exceeding normal anticipated operating conditions for periods up to 18 days. The tests corroborated results reported from major research and testing programs.

Public Works, 104(4):88-91, April 1973.

0134

CONSTRUCTION METHODS AND EQUIPMENT

In West Germany, pipes from polyvinyl chloride (PVC) will replace between 80 and 90 percent of all pipe materials in new pipelines to be built by 1975. Advantages of PVC pipes include: complete resistance to corrosion both inside and outside; a high insulating capacity, thus no corrosion due to stray ground electrical currents; a high aging resistance; no interior incrustation; and, higher flow-passing capacity due to surface smoothness. Also simple and inexpensive joints which are easy to insert into the pipe end by hand can be used. The joint, together with rubber sealing, allows for all possible expansion and contraction of the pipelines. Generally a work team of 3 to 4 can lay 400 meters of pipeline in an 8-hour shift.

Wasserwirtschaft-Wassertechnik, 23(1):320-34, 1973.

0135

MODEL STUDIES

The economies of scale of wastewater treatment plants favor regional systems. Thus, the methods of operations research and systems analysis used in planning for more efficient new pollution control facilities or upgrading existing systems are important. The major question herein investigated is the following: Given a number of communities and/or industries in a geographic area, where should treatment plants be built, how many, at what time, and which intercepting sewers are necessary to connect the municipalities and industries to these plants, such that the total cost of wastewater collection and treatment is a minimum. From a general formulation of the problems and an approach for solving their resulting minimization with concave objective functions, it appears that any small to medium sized problems can be solved in reasonable time.

Water Research, 7(4):633-646, April 1973. 14 refs.

0136

A simple two-stage model is developed for infiltration under a constant intensity rainfall into a homogeneous soil with uniform initial moisture content. The first stage predicts the volume of infiltration to the moment at which surface ponding begins. The second stage, which is the Green-Ampt model modified for the infiltration prior to surface saturation, describes the subsequent infiltration behavior. Comparison of the model predictions with experimental data and numerical solutions of the Richards equation for several soil types shows excellent agreement.

Water Resources Research, 9(2):384-394, April 1973. 23 refs.

0137

A mathematical model, based on the principles of hydraulics, has been developed to describe the head-discharged relationships for various combinations of ferrules and house service pipes commonly used in Calcutta. From the experimental results it was possible to derive the relationship $Q_x = A_s^n \left(\frac{l_x}{l_1}\right)^n$, a modification of the well established head-discharge relationship $Q = KH^n$. In this expression, $A=Kl_1^n$, l_1 is the base length, K the constant for a particular ferrule-service pipe combination, $n = 0.54$ for all combinations, and $s = \frac{H}{l_x}$, where H is the dynamic water head in street water main and l_x the length of a house service pipe. The values of A for all combinations of ferrules and pipes were experimentally determined. Using the values of A, discharge from a given length of pipe under a given dynamic head may be computed. A set of graphs relating Q and s has been provided for all combinations of ferrules and house service pipes for quick estimation of probable discharges.

Journal of the Institution of Engineers, India, 53(PH1):14-20, October 1972. 2 refs.

0138

GOVERNMENT-SPONSORED REPORTS

Laboratory process development of a unique physical-chemical wastewater treatment process followed by design, construction, and field demonstration of a 100,000 gpd mobile pilot plant has been undertaken by Batelle Pacific Northwest Laboratories. In the treatment process, raw wastewater is contacted with powdered carbon, coagulated with alum, settled with polyelectrolyte addition and, in some cases, passed through a tri-media filter. The solids from the clarifier, composed of raw sewage solids, powdered carbon, and aluminum hydroxide floc, are readily dewaterable to 20-25 percent solids by direct centrifugation with the powdered carbon acting as a substantial aid to dewatering. The dewatered solids are passed through a fluidized bed furnace developed specifically for powdered carbon regeneration. Alum is recovered by acidifying the regenerated carbon slurry from the furnace to a pH of 2. The recovered carbon and alum are recycled as an acidified slurry and added to the raw sewage with the makeup carbon. The program demonstrated the ability of the treatment process to consistently produce high-quality effluent from raw wastewater. Powdered carbon regeneration was highly successful on the pilot scale. Full capacity recovery was achieved with less than two percent carbon loss per regeneration cycle. Alum recovery was also greater than ninety percent.

EPA/ORM Report No. EPA-R2-73-149, Contract No. 14-12-519, Project No. 11020 DSQ, February 1973. 178 p, 14 refs.

0139

A study of the application of thermal techniques to the measurement of flow rates in combined sewers has been conducted by Hydrospace-Challenger, Inc. The utilization of flush-mounted hot wire or hot film anemometers in a direct reading mode was extensively investigated. It was concluded that such a direct reading application was not feasible due to shifts in calibration caused by the build-up of contamination and the lack of commercially available units with sufficient ruggedness and reliability for application in a combined sewer pipe. A particular technique, based upon measuring the time-of-flight of thermal pulses generated at various positions around the periphery of the pipe, was investigated in depth. A full scale prototype unit was fabricated and tested. These tests indicated that the configuration does not provide signals which have precision to enable the measure of fluid flow with the desired accuracy.

EPA/ORM Report No. EPA-R2-73-145, Contract No. 14-12-911, Project No. 11020 EYD, March 1973. 100 p, 66 refs.

0140

TREATMENT METHODS, SYSTEMS & EQUIPMENT

The Tollemache treatment plant has been evolved after close examination of the faults and undesirable features of many packaged sewage plants as well as analysis of conventional methods of building and installing sewage purification plants and equipment. The main points are cost effectiveness both in capital investment and operational efficiency and time function with respect to installation and use. This plant has unusual features comprising a truly spiral aeration feature. Unlike most packaged plants the diffusion takes place longitudinally in a rectangular tank. The tank capacity allows a 100 percent sludge return. A self-cleaning screen is a feature of the design which takes advantage of the agitated liquid surface of the aeration unit to flocculate the screenings, held back by closely placed screen bars, up these bars to a platform at the top of the incline. These screenings are thoroughly washed by the liquid and require far less time in removal or frequency of removal. The screening unit is constructed from a special non-corrosive material and has a long life. The settlement tank of smaller plants is designed on the inverted pyramid principle, the liquid leaves the aeration unit and enters the settlement unit via a large stilling arrangement which extends the entire width of the settlement unit. The mixed liquor is therefore deflected a considerable distance towards the point where the sludge is removed for return to the aeration unit. The sludge in the settlement unit settles out at the apex base of the inverted pyramidal tank and is picked up and discharged by an air lift to the aeration unit. The settled effluent is discharged from the settlement tank by means of a serrated weir. This is serrated on one side only, the other side acting as a scum board.

Water and Waste Treatment, 16(2):12-13, February 1973.

0141

Drinking water purification methods which utilize alum or iron coagulation leave a sludge which is difficult to dewater due to its gelatinous properties. A new water treatment process, developed by A. P. Black and Cliff Thompson, uses magnesium carbonate as the coagulant which is recyclable. In this process, lime slurry is added to raw water which contains either naturally occurring magnesium bicarbonate or magnesium carbonate which has been added. The addition precipitates magnesium hydroxide and calcium carbonate. The magnesium hydroxide acts in a manner similar to the hydrolysis products of iron or aluminum salts and forms a floc which settles impurities out of the water. In essence, the treatment system is a combination softening and purification process. Presently, the cost of lime-alum treatment, without provision for sludge handling, is $8-10 per million gallons. The cost for magnesium carbonate treatment, with purchased CO_2, high calcium lime, and purchased $MgCO_3$, without recycling of lime is about $19 per million gallons. If dolomitic lime could be used and could serve as a magnesium source, the costs would decrease to about $12/million gallons.

Environmental Science and Technology, 7(4):304-305, April 1973.

0142

The Fairfax County, Virginia Wastewater System consists of 1400+ miles of sanitary sewer lines, 32 pumping stations, and nine treatment plants. The total wastewater flow in the county is approximately 50 mgd, of which 33 to 35 mgd is treated by county plants. In July 1970, Fairfax County embarked on a major sewer improvement program with the objective of reducing the total pounds of BOD_5 discharged to the Potomac river. As a result of investigations, three treatment plants will be taken out of operation and major emphasis placed on expansion and additions of advanced treatment processes at the Lower Potomac Plant, one of four major facilities. Advanced Wastewater Treatment (AWT) facilities to be installed during 1973-1974 at the Lower Potomac Water Pollution Control Plant will have an average daily capacity of 36 mgd and a peak flow rate of 68 mgd. Based on raw sewage concentrations of BOD_5, phosphorus, and nitrogen of 225 mg/liter, 15 mg/liter, and 50 mg/liter respectively, the AWT facilities are designed for overall treatment plant removal efficiencies as follows: BOD_5 - 98.3%, phosphorus - 98.7%, and nitrogen - 98%. The AWT process consists of the following: chemical treatment with calcium of secondary effluent in solids contact treatment tanks; recarbonation in two stages with intermediate settling; filtration on granular multimedia filters to assure removal of unsettled phosphorus precipitates; and, breakpoint chlorination.

Water and Waste Engineering, 10(3):38-39, March 1973.

0143

Presently the City of Newport, Rhode Island provides water service within the City limits and to areas in the Towns of Middletown and Portsmouth. Since 1956 there has been a substantial increase in water consumption and in 1963 the City was urged to take measures to safeguard water quality from biological contamination resulting from lack of cover over treated water storage reservoirs. Improvements since 1965 include: a new 3-mg welded steel storage tank to replace the open storage reservoir, a welded storage tank with 1.5 mg capacity near the Town lines where water consumption has increased rapidly, two intake and pumping stations, expansion of an existing treatment plant from 4 to 8 mgd average, and the rehabilitation, replacement, or installation of approximately 18 miles of mains. With the completion of construction three service areas now supply this region; yet, with unanticipated population growth the available surface water and usable groundwater supplies are rapidly depleting.

Journal of the New England Water Works Association, 87(1):41-46, March 1973.

0144

TUNNELING

A tunnel boring machine (TBM) recently holed through a 4180-foot storm drainage tunnel in Euclid, Ohio. The TBM, made by Jarva, Inc. of Solon, Ohio, has a rotating cutterhead that operates within a steel shield in soft ground, but can be extended forward of the shield when mining in hard rock. To cope with any shield rotation, the $780,000 TBM's cutterhead operates in either direction. The machine's best day of advance was 45 feet in a mixed face of shale and clay, functioning alternately as a hard rock boring machine and a soft ground shield-type.

Engineering News Record, 190(16):17, April 19, 1973.

0145

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

A sampler has been devised and patented by Roman R. Carr which integrates automatic sampling with flow measurement. It is capable of sampling in proportion to flow and at the same time, it provides a simple means of determining flow from the volume of samples collected. A plastic pipe with a special insert serves as the main body of the sampler when the liquid flow in an open channel is controlled by a weir or flume. Solenoid operated tapered plungers seated in rubber sleeves provide the valving. Daily flow is ascertained by multiplying the total volume collected by the formula constant for the weir or flume used. The simultaneous use of one of these samplers on the raw wastewater after a comminutor or similar device and another on the final effluent, would allow operators to experiment with procedures to increase plant efficiency.

Public Works, 104(4):71, April 1973.
1 ref.

0146

A mobile irrigation unit, designed for measurement of rainfall-runoff, soil erosion, and ground infiltration, can be used almost anywhere. The unit, carried on a Volkswagen bus with trailer, has 22 nozzles emitting water at a maximum of 99 mm/h. Water can be pumped from a source nearby, or transported in the bus. The precipitation is measured with 15 Hillmann rain gages on the ground and the volume of water used is checked with a water meter installed between the pump and the nozzles. The area sprinkled, .25 meters, is bordered off by metal sheets dug into the ground or by ditches stabilized with a holding preparation. The collecting system consists of inclined metal sheets adjoining large metal funnels with trap spaces for eroded soil and an outlet for water. Water is collected into calibrated fiber metal tubes and seepage is measured with two weight-gage cylinders staked in the ground. The work includes determinations of the ground profile and features, and soil analysis.

Wasser und Boden, 25(3):63-65, 1973. 8 refs.

0147

Many wastewater treatment plants, whether being modified to meet new and more rigid quality standards or being designed for new urban areas, are faced with a critical shortage of available head. As a consequence, standard flow-measuring devices often become submerged and then lose all reasonable accuracy necessary to monitor the flows effectively. To remedy this condition, a procedure for flow analysis, found very applicable in other open channel measuring structures, has been applied to a cutthroat flume. This procedure can be easily implemented in wastewater treatment plants. The principal advantages of the cutthroat flume are basically its flat bottom, simple construction, and generalized ratings. In each case, the cutthroat flume results in time and money savings at other points in the treatment plant. In addition, the method of flow analysis and the hydraulic characteristics of the flume are helpful in designing certain upstream unit operations such as grit removal because of the velocity control characteristic that can be incorporated.

Journal of the Water Pollution Control Federation, 45(3):542-551, March 1973. 5 refs.

0148

In order to meet more stringent pollution control requirements, municipalities have found it necessary to correct problems created by existing combined sewer systems which suffer from wastewater overflows. Preceding correction, analysis of combined sewer overflow systems must be performed and the usual method is based on flow measuring programs at specific overflow points. This method provides accurate results only if the gaging installation is functioning properly. Thus a rational method of analysis has been developed which determines the number, duration, and volume of overflows occurring in a system with various intercepting capacities as well as the capacities of storm storage tanks and overflow treatment facilities required to provide various degrees of overflow reduction. This concept may be adapted to any region provided that rainfall data are available from a nearby weather station and the percentage of runoff can be determined.

Journal of the Water Pollution Control Federation, 45(3):434-448, March 1973. 11 refs.

0149

PATENTS

A safety installation for preventing pollution by pipeline has been patented by G. F. Wittgenstein of Switzerland. The installation is provided with at least one sector equipped with a jacket of plastic material. The jacket surrounding the pipeline is sealed at its ends with the annular gap formed between the pipeline and its jacket containing a fluid and inserts and spaces. At least one vessel is provided for collecting the evacuated flow and liquid presence detector which gives a warning and remotely controls operations. A fluid-tight hollow space contains a gas under a pressure different from atmospheric pressure and connects the interior of at least one vessel to a crack in the pipe wherever the crack occurs. Instruments permanently monitor the tightness of the space, which comprises at lease one perforated gap. Near each vessel is a liquid presence detector and every horizontal run gap of the space is filled with water. The jacket is pierced by at least one perforation, and there is a chimney surrounding the perforation. A channel leads into the chimney above the level of water and to a vessel to form part of the space. Every inclined run gap of the space is perforated at a low point in its jacket, and the channel surrounding the perforation and leading to the vessel forms part of the space.

United States Patent 3,721,270. Applied September 2, 1970. Issued March 20, 1973.
0150

A method and apparatus for controlling the flow of fluid in a supply pipe to a premises such as a water supply pipe or a gas supply pipe has been developed by Eric G. B. Gledhill. A small bore high pressure tubing is provided preferably alongside the standard supply pipe and communicates between a main stopcock arranged to control the flow of fluid from a supply into the premises' supply pipe and the various valves in the premises. The main stopcock and the control valves have an apertured diaphragm providing the only means of communication between the small bore tubing and the supply pipe. When one of the control valves is opened, pressure is released in the small bore tubing to lift the diaphragm off the seat of the main stopcock to permit flow of fluid through the main stopcock into the supply pipe and vice versa. It is envisaged that instead of relying upon pressure signals to open and close the main stopcock, electrical signals can be used. Clearly, by fitting such apparatus into a domestic water or gas supply, water or gas will only flow into the domestic system through the main stopcock when required. Thus, wastage of water or gas in the event of a leak in the pipeline between the main stopcock and the premises will be prevented.

United States Patent 3,722,520. Applied February 3, 1971. Issued March 27, 1973.
0151

The Cole Resedevel Corp., Fairlawn, New Jersey has been granted a patent for a sewage treatment apparatus. This disclosure relates to an apparatus and method for treating domestic and/or industrial wastewater to render the same into a condition for either further reuse in industrial processing or for outflow into natural waters. The treatment utilizes the principles of electrolysis to ionize the water utilizing the sodium of sodium chloride to form sodium hydroxide and the chloride as a bleaching agent. The treatment takes place in a simple two stage cell.

United States Patent 3,728,245. Applied January 13, 1971. Issued April 17, 1973.
0152

A patent has been awarded to Rudolf Lautrich for the development of a mixed water drainage system. This system has a rain overflow in each bypass channel before it opens into the main channel. It is dimensioned to correspond to a greater mixing ratio than that in the rain overflow which follows in the main channel.

German Patent 1,484,877. Applied June 16, 1964. Issued February 22, 1973.
0153

A tertiary treatment domestic sewage treatment plant has been patented by Sanitary Disposal Systems, Inc. of Wheat Ridge, Colorado, which effects particle size reduction by hydraulic action. The system utilizes extended aeration and adiabatic cooling of the surface of the treating bath to enhance oxygen absorption and is provided with a living filter.

United States Patent 3,731,812. Applied February 25, 1970. Issued May 8, 1973.
0154

A method for comparing the statistical efficiency of the estimate of the T year flood, $Q(T)$, by two different methods has been developed. On the basis of commonly used assumptions it is shown that for return periods greater than about $T = 10$ years, the annual exceedance series estimate of $Q(T)$ has larger sampling variance than the annual maxima series estimates. It is further shown that for the range of return periods, the partial duration series estimate of $Q(T)$ has smaller sampling variance than the annual maxima series estimate only if the partial duration series contains at least 1.65 N items, where N is the number of years of record.

Journal of Hydrology, 18(3/4):257-271,
March 1973. 9 refs.

0155

The relative regeneration performances of five linear rainfall excess-direct runoff models have been compared for several urban watersheds with varying degrees of development. The five models considered include the single linear reservoir, the Nash model, the double routing method, the linear channel-linear reservoir model, and the instantaneous unit hydrograph (IUH) obtained by the Fourier transform method. The IUH always gave the best regeneration performance among the four conceptual models tested. The optimized single linear reservoir constant differs from the theoretical time lag value, but is related to the latter, and for each watershed varied from storm to storm. For larger watersheds the Nash model parameters for each watershed were found to vary from storm to storm. The quality regeneration for larger basins was less than that found for the smaller basins.

Journal of Hydrology, 18(3/4):329-347,
March 1973. 20 refs.

0156

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WATER SUPPLY AND ITS MANAGEMENT

Water quality data relating to the surface and coastal waters of Northern Ireland are at present very limited. However, the Department of Industrial and Forensic Science (DIFS), Ministry of Commerce, has since 1949 undertaken numerous water quality examinations over much of the province in relation to specific incidents or effluent disposal problems. The Fisheries Conservancy Board and Foyle Fisheries Commission also have developed considerable knowledge of pollution problems in Northern Ireland, as have the public health authorities. In order to obtain the necessary data, water quality sampling stations are being established throughout the country, which has been divided into seven hydrometric areas. The stations are situated on tributaries and at the mouths of major rivers and in relation to principal discharges or areas of special interest for amenity or other purposes. Each station is calibrated to ensure that any sample from it is representative of the river water quality in the immediate vicinity.

Water Pollution Control, 72(1):10-19, 1973. 11 refs.

0157

Between 1960 and 1970 the permanent population of Las Vegas, Nevada increased from 127,000 to 270,000. Under this pressure, the water table was dropping at a rate of 10 feet per year. In some places the ground actually sank. To solve the problem, the Bureau of Reclamation worked with city, state, and federal governments to find a new source of water for Las Vegas and the surrounding area. A 200-foot deep reservoir was blasted from the rock about 1.5 miles from Lake Mead and a lateral tunnel was drilled to connect the new reservoir to the lake. The motors for ten turbine pumps were installed in a building constructed on top of the reservoir. The pumps were lowered 120 feet to lift the water for transportation to the city. The pumps are capable of pumping as much as 200 mgd to the Las Vegas area. The water flows four miles through a 12-foot diameter tunnel through an adjacent mountain range.

Water and Sewage Works, 120(4):68-70, May 1973.

0158

The water supply in Riyadh, Saudi Arabia and in the Eastern Province is mainly underground water with solids concentration averaging about 2500 mg/liter. This salty water is unfit for drinking and many other domestic uses. To alleviate this situation the government is conducting a comprehensive program to construct conventional water treatment plants, distribution nets, and a desalination plant. The city now obtains water from three different systems: the alluvial layers in Wadi Hanifah and its tributaries, the fairly shallow Riyadh sandstone in Wadi Nisah, and the very deep-lying Mirjur sandstone. Water is also obtained from the limestone under the city, but this supply is used only for irrigation. Water for the eastern area comes from aquifers 300 feet wide and 400-500 feet deep. Seven major aquifers all in sedimentary rock of lower Cretaceous to Neocene age, contribute to the water supply of this area. All the aquifers have established regional hydraulic gradients that decrease with fair uniformity to the east and north, following the dip of the sedimentary strata of the margin of the Arabian shield. Modifications to the regional gradient are caused by local structural growth anticlinal trends, pressure release points in the Arabian Gulf, and the effect of recharge along the major Wadi systems. The regional water quality gradients show a general increase in salinity to the east and north. In comparing the two water systems, Riyadh has a comparatively sophisticated water treatment system, which includes coolers, sedimentation, filtration, chlorination, etc. The only treatment in the Eastern Province is direct chlorination. However, the water of the eastern area is of far better quality, in spite of the high concentration of dissolved solids.

Water and Sewage Works, 120(4):84-89, May 1973.

0159

A study has been conducted to evaluate the factors affecting residential and industrial water use in Australia. Analyses were carried out on water-use data for the major metropolitan areas, and specific residential water-use data were collected and analyzed for three study areas in Victoria. A comparison of water-use rates versus population for fifteen metered Australian cities with the demand estimated by these formulas shows little correlation and said use is unrelated to city size. The climatic variable most correlated with annual per capita water use in Australian cities is the number of days of rain per annum. Use tends to decrease as the average maximum temperature increases due to high average maximum temperatures occurring in the tropical northern regions of Australia where considerable summer rainfall decreases the need for garden watering. Urban water use in Australian cities for the year 1985 has been estimated by trend extrapolation methods. Typical rates of growth in total water use are 4-5 percent per year. Typical per capita water-use growth rates are 1-2 percent per year. The growth rate in total water use for Canberra is 8.9 percent per year, largely due to a rapidly increasing public service population. On the other hand, for Geelong, a developing Victorian industrial city with a population in excess of 100,000, the growth rate in total water use is 6.9 percent per year, whereas the growth rate in per capita use is 3.0 percent per year.

Journal of the American Water works Association, 65(4):232-237, April 1973. 26 refs.

0160

MEASUREMENT AND MONITORING

A wet digestion process has been developed to prepare water and biological samples for kinetic determination of mercury using an iodide-catalyzed reaction between cerium(IV) and arsenite(III). A mercury-free control, prepared using ion exchange with a selective chelating resin, was used by adding mercury standards to make a calibration curve. Both inorganic and organic mercury can be determined by the method described either in water or biological samples containing mercury in the range of 0.05 to 2.0 µg per ml. The procedure can be used satisfactorily down to the 0.05 ppm level for fresh water and urine with an overall error of less than five percent. The method can also be employed for the determination of mercury in sea water or blood serum with an error of 10 percent or less and gives results which compare favorably with other procedures.

Microchimica Acta, (3):417-427, 1973. 39 refs.

0161

An automatic, on-line monitoring system for the sanitary sewage effluent from the Lawrence Livermore Laboratory in California has been constructed. It can detect, at levels lower than United States Atomic Energy Commission guidelines, all radioisotopes in use at the Laboratory, and it monitors pH continuously. It is wired into a central alarm system which alerts personnel on a 24-hour basis.

American Industrial Hygiene Association Journal, 33(10):693-699, October 1972.

0162

A technique for measuring small pressure differences in water, corresponding to water velocities of down to 0.04 meters per second has been developed. The system is a modification of Preston's twin reservoir technique, using an inclined U tube manometer. Results accurate within one percent were achieved by this system, which has a slightly faster response time than former techniques, in addition to being simpler in construction.

Journal of Physics: E. Scientific Instruments, 6(1):77-78, January 1973. 3 refs.

0163

A radioactive system for broad angle detection of pipe flow measurement using AERE 1413A scintillation rate-meter, gives flatter wave forms with lower repeatability and requires relatively higher radiation mass dosages per injection as compared with a narrow angle detection device. However, using an automatic on/off light system set at a preselected radiation threshold level, this system gives excellent repeatability and requires low radiotracer concentrations per injection. The instrumentation is light and portable, and requires no expert supervision. The criteria for selection of the tracer method are speed and convenience rather than high accuracy and precision. However, an accuracy of ±5 percent can be achieved and the danger from radiation is negligible.

The Civil Engineer in South Africa, 15(2):33-38, February 1973. 7 refs.

0164

HYDROLOGIC ASPECTS

Some of the most extensive flooding in recent decades occurred along the main stem of the Mississippi River from Iowa to the mouth, as a result of high carryover flow from March, augmented by extremely high rates of tributary inflow during April. At monthend, more than 11 million acres of land had been inundated and stages were rising again in some reaches. Severe flooding, resulting from record-high stages and discharges, occurred on some Mississippi River tributaries in Wisconsin, Iowa, and Missouri, and on streams in Maine, New Brunswick, and Florida. Lakeshore flooding, resulting from strong easterly winds, occurred along portions of Lake Erie in Ohio and Michigan. Large areas of above-normal streamflow persisted in southwestern, central, and southeastern parts of the United States. The large area of below-normal flow in the northwestern States expanded into parts of Montana, Wyoming, and Utah during April. Drought conditions intensified in much of Puerto Rico where streamflow was approaching the lowest flows recorded in the past 15 years. Water rationing was imposed on several communities.

Water Resources Review, p. 1-13, April 1973.

0165

Analytical expressions for the error in the area-averaged rainfall as estimated by a network of rain gages and the fluctuations in the estimate have been derived. The actual variance of the area-averaged rainfall in terms of the mean, the mean square, and the space autocorrelation function of the areal distribution of rainfall also has been examined. The error equation is evaluated for an exponential autocorrelation function and a simple approximate expression obtained.

Journal of Hydrology, 18(3/4):243-255, March 1973. 5 refs.

0166

In 1967 a report from the Institution of Civil Engineers drew attention to the need for a 1933 publication on reservoir flooding to be updated in light of subsequent improvements of techniques in flood hydrology. As a result, a team of hydrologists started a three-year investigation at the Institute of Hydrology, Wallingford, England. The study, due for completion in 1973, is examining various aspects of the magnitude/frequency problem associated with flood hydrology using two approaches. One is a statistical study of instantaneous peak flows and the other is concerned with catchment response and is therefore a study of particular rainfall-runoff events. It is this second approach which has required the collection and processing of a considerable quantity of flood event data. Antecedent condition, storm rainfall, and flow hydrograph data have been assembled for over 1500 events from 151 catchments.

Water and Water Engineering, 77(925):91-95, March 1973. 3 refs.

0167

SEWER SYSTEMS

A fast, effective dewatering system is overcoming severe water problems and speeding excavation and pipelaying operations at a major housing project near Quebec City, Canada. La Compagnie J. A. Auclair Limitee, Giffard, Quebec, is employing the Keller method of groundwater control to install sanitary sewers and watermains for Development Iberville at Ville de Belair. To predrain, the contractor is sinking a series of 2-inch diameter wellpoints which are self-jetting with pressure supplied using either a water hydrant or a special portable jetting pump. Once in position at the desired depth, the wellpoints are connected to a 6-inch diameter header pipeline by flexible hoses. This header line runs on the surface to a high-capacity suction and dewatering pump. The main advantage for the method lies with its speed since reportedly up to 60 wellpoints can be installed per 10-hour shift. A key reason for the quick installation is the use of Kardan couplings which permit connections to be made without tools in about 10 seconds or less.

Engineering and Contract Record,
86(5):80, May 1973.

0168

Design of new replacement lines, rehabilitation of existing lines, and the data needed to choose intelligently between them, is being provided for part of Baltimore, Maryland's new $17 million Southwest Diversion Sewer Project by underground television inspection and photographic analysis. Positive identification of leakage and structural failures in the old interceptors located in the immediate vicinity of the new pressure sewer hopefully will save thousands of dollars of pipe construction costs and permit more economical wastewater treatment. The TV inspection service is under contract to Robinson Pipe Cleaning; consulting engineer is the Beavin Company, Baltimore, Maryland. At the same time, eliminating clear water infiltration from Ripon, Wisconsin's sanitary sewer system, as ordered by the Wisconsin Department of Natural Resources has been solved using the same method. A planned schedule of sewer inspection and repair over a three year period was instituted. One-third of Ripon's lines are being inspected each year by television to establish the condition of all 15 miles of Ripon's pipes. The small costs are more than covered by the regular maintenance budget.

Water and Wastes Engineering, 10(5):31, 42, May 1973.
Water and Sewage Works, 120(4):110-113, May 1973.

0169

The original area of approximately 9000 acres for Telford New Town drains to the River Severn in England with the new drainage area of about 10,000 acres flowing to the River Tern, a tributary of the Severn. At the time the designated area was expanded, long lengths of the sewers in the southern area had been constructed with no allowance being made for future development in surrounding sections of the catchment area. The effect of extending the boundary of the new town was to introduce new areas for development within the southern catchment region. It was found possible to alter the proposed sewer network and to introduce an extra balancing reservoir in such a way that flows in the sewers already constructed would not exceed the designed capacity. Two contracts were let for this work: the first, for sewers and land reclamation work; and the second, for sewers in tunnel and open cut and the construction of a siphon draw-off from the balancing reservoir. The Randlay/Hollinswood sewers, used in the projects, will provide drainage for additional areas and will provide the link to divert flows through the extra balancing reservoir.

Surveyor, 141(4218):49, April 13, 1973.

0170

An $889,078 contract awarded to Fedex Ltd., in October 1972 consists of placing 1600 feet of 10-foot diameter concrete horseshoe storm collector and 36-inch diameter sanitary sewer pipe in open cut to depths of 30-feet between the Maisonneuve and St. Etienne Street intersection in Hull, Quebec. Since beginning the contract, Fedex crews have been hampered by a serious lack of working area. Thus the patented Contact Sheeting system to shore up both sides of the 24-foot-wide trench was employed. This system involves driving a row of wide flange steel soldier beams along both sides of the proposed excavation, and as the excavation advances, short lengths of heavy timber sheeting are cut and fitted in front of the vertical beams. To handle the earth and rock moving operations, Fedex is using an equipment spread consisting of three Poclain backhoes - an RC-200, a GC-120, and an LC 80, plus an International TD-15 dozer, an International TD-175-B front-end crawler loader, a Terex 72-41 rubbertired loader, and four Ford series 8000 tandem dump trucks. The method employed for most of the project is to operate a 1.25-yard GC-120 backhoe on the floor of the trench and have the unit deposit excavated material off to one side of the machine. From the side of the trench wall and the hydraulic backhoe, the International loader moves the material to another Poclain unit, the RC-200, located at the top of the advancing trench. The 2-yard machine in turn reloads the material and dumps it into the Ford tandem trucks.

Engineering and Contract Record,
86(4):42-43, April 1973.

0171

A 30-inch corrugated steel sanitary sewer has been suspended from the ceiling of a 9-foot concrete storm sewer, 6400 feet long, in Pontiac, Michigan. With the storm drain serving as the conduit for the sanitary sewer line, substantial cost savings were realized over two separate lines. Both sanitary and storm sewers are new in the project known as the Joslyn Drain. The corrugated steel pipe, with asbestos fibers embedded in its zinc coating, was specified for its high degree of corrosion resistance. Tight joints, giving the necessary water-tightness, were specified to eliminate exfiltration. And, in addition to being reasonably light in weight, the steel pipe offers the necessary high beam strength. Inside the pipe, the corrugations are filled to improve flow. U-shaped steel bands support the sanitary sewer pipe with each leg anchored by bolts to the roof of the storm drain. Grouting in the minimal space between the two conduits at each support band ties the sewer structure together and helps it resist end forces.

Civil Engineering - ASCE, 43(5):93, May 1973.

0172

The installation of sanitary sewer lines and storm drainage was an early priority for Co-op City in Bronx, New York since new owners were moving into their apartments as soon as each building unit was completed. Over 60,000 feet of sanitary lines, force sewer mains, and storm drains were laid in the troublesome loose soil environment by Di Menna & Sons, Inc. For the force main portion of the sewer network, Di Menna chose 20-inch diameter, 3/8-inch wall Raymet spiral-welded steel pipe and fittings. The pipe and fittings were made to order by Raymond Metal Products Co., Baltimore, Maryland. After pipe production was completed, the pipe was shipped to Standard Pipe Protection, a division of General Steel Industries, Inc., Kearney, New Jersey where it was treated to a cold coat of coal tar primer and a hot coat of coal tar enamel. Then it was wrapped in fiberglass and given another hot coat of coal tar enamel. It was then afforded a final wrap of kraft paper. The pipe was then shipped to Raymond's Centriline Division plant in Oakland, New Jersey for a cement lining approximately 3/8-inch thick. The pipe was supplied with ends prepared for Dresser couplings. All fabricated elbows and offsets were custom designed to meet site requirements. The fabricated fittings were tested at a minimum of 125 psi.

Excavating Contractor, 67(4):31, April 1973.

0173

GOVERNMENT-SPONSORED REPORTS

An environmental impact statement has been prepared by a project planning and engineering consultant to the Seattle Department of Engineering. Now under construction, a project to collect floor water from 210-acres in the North Greenwood section of the city and channel it into Piper Creek at Carkeek City Park, which flows into Puget Sound, will cost approximately two million dollars. The study took much less staff time than was initially felt necessary and was completed under the direction of landscape architect Michael J. Brooks and assisted by several hydraulics engineers, members of the staff of Wilsey & Ham, Inc. Also contributing were two sub-consultants, a biologist and an environmental geologist, who aided by conducting an environmental inventory and analysis encompassing geological history of the creek area, superficial and bedrock geology, groundwater, stream economics, water chemistry, aquatic biology, and terrestrial biology.

Western City, 49(4):16, 19, April 1973.

0174

MODEL STUDIES

A quantitative methodology, utilizing Kalman filtering techniques, has been developed for designing water quality monitoring systems. A basis is established for improvement of current practices of specification and enforcement of water quality standards, and evaluating the economic trade-off between temporal and spatial frequency of sampling. Monitoring systems are characterized by spatial and temporal frequency of sampling and the variables to be measured. Utilizing a dynamic model of the aquatic environment and estimates of the uncertainty in model error and measurement error, a best sampling program is selected from a set of feasible sampling programs by sequentially minimizing a specified measurement system cost function.

Journal of Hydraulics Division, ASCE, 99(HY5):815-831, May 1973, 12 refs.

0175

The Sutlej River below Rupar Barrage, India, started eroding its right bank opposite the Bist Doab Canal, which runs parallel. The river edge had come as close to the canal as 48.77 meters. Consequently the problem was referred to the Punjab Irrigation and Power Research Institute for evolving suitable remedial measures to check further erosion of the river bank. A model of Sutlej River, Rupar Barrage, and the necessary reach of the Bist Doab Canal was accordingly constructed to a horizontal scale of 1/150 and a vertical scale of 1/30. The model was run with different discharges and different remedial measures were examined. Ultimately a scheme comprising construction of three armored spurs, each 33.53 meters long, on the right bank of the river was finalized. Due to a time factor, balli sarkanda spurs were constructed in 1970. These temporary structure have been observed to function satisfactorily and give necessary protection to the right bank.

Indian Journal of Power and River Valley Development, 22(12):479-484, December 1972.

0176

The dimensioning of open cut canals used for bringing irrigation water or for evacuating excess waters from drainage systems has been elaborated in a mathematical model for use in a number of cases. The calculus was based on the following classical formulas: $\frac{Q}{i} = f(m,h,b)$ where Q represents the flow; i, the slope of the water table and the canal end (constant and uniform flow); b, the small base of the considered section; h, the average depth of the current; and, m, the canal slope (the cotangent of the slope bent). The second formula is $\bar{u} = \frac{Q}{S}$, where u equals the speed condition and S represent the water flowing surface. Determination of water flow (slow, critical, or swift), established by the value of Froude's number, also was taken into consideration. This is equation $Fr = \frac{h_{ert}}{h}{}^{3}$ where: Fr represents Frounde's number equal to $\frac{\alpha Q^2}{S^2 gh}$; α, Coriolis' number, equal to 1.1; g, the acceleration of gravitation; and, h_{ert} equal to the critical depth of the water resulting from the finding of the minimum of H - the specific energy of the section ($\frac{\partial H}{\partial h} = 1 - \frac{q^2}{gh^3}$, when q is the flow of the canal width unit).

Economic Computation and Economic Cybernetics, Studies and Research, (4):99-106, 1972. 7 refs.

0177

PATENTS

An apparatus for cleaning loose filtering material in slow water-filled water supply filters, comprising a washing chamber equipped with means for its movement relative to the suface of the loose filtering material being cleaned has been patented by B. F. Volokh of the Soviet Union. Mounted inside the washing chamber are washing tubes to feed clean water into the layer of filtering to be washed. The washing chamber connects with a suction pipe which passes the dirty water. The chamber is provided with means for regulating its pressure upon the filtering material controlling its degree of buoyancy.

United States Patent 3,732,983. Applied March 29, 1971. Issued May 15, 1973.

0178

A screen retainer assembly for use in a conduit has been patented by Robertshaw Controls Company of Richmond, Virginia. This method includes the steps of draping the screen across a convoluted band of ductile material, positioning the screen-draped band within the conduit in general alignment with a continuous groove provided in the interior surface of the conduit, and expanding the convoluted band so that the band fits snugly in the groove thus to hold the screen firmly in place with its periphery pinched between the band and the groove. The resultant screen retainer assembly has the advantages that the screen retaining means does not impede the flow of fluid through the conduit and that the expanded band cannot become displaced or accidentally removed.

United States Patent 3,732,985. Applied May 24, 1971. Issued May 15, 1973.

0179

An invention representing a new concept in liquid processing particularly in sewage treatment utilizes air, oxygen, or a carrier gas with ozone as an attenuator of anaerobic biota, for generalized disinfection, for aeration, or for oxygenation. Essentially, unique designs and/or processes are incorporated into the conventional settling tanks associated with sewage treatment, as well as in the bioprocesses, activated sludge or trickling filter operations. The structural improvements in settling reduce velocity, inhibit boundary layer separation, and act to suppress mixing of the sewage to greatly enhance solid and fluid separation. In the bioprocessing operations, the key is to improve efficiency of the liquid-gas exchange whereby much better oxygen contact is achieved. The liquid-gas exchange feature utilizes a high momentum exchange under turbulent flow conditions in a hydraulic pressure gradient to achieve intimate mixing of the desired gas in the fluid so as to achieve the desired very reliable and efficient liquid-gas exchange.

United States Patent 3,730,881. Applied December 21, 1970. Issued May 1, 1973.
0180

A patent has been assigned to the Environmental Protection Agency for a wastewater purification method which utilizes breakpoint chlorination and carbon adsorption. In this process, sodium hypochlorite or chlorine is used to oxidize the ammonia in raw, secondary and lime clarified municipal wastewaters using breakpoint chlorination. Carbon adsorption columns are located downstream from the breakpoint chlorinator. In wastewater, the breakpoint requires a minimum chlorine dose of approximately an 8:1 weight ratio of $Cl:NH_3$—N in lime clarified secondary effluent. A slight chlorine excess is used which is adsorbed by the carbon thereby inhibiting slime buildup.

United States Patent 3,733,266. Applied September 7, 1971. Issued May 15, 1973.
0181

A sewage purification process wherein sewage is contacted with ozone and other gases after optional pre-purification in a recirculation system under substantially atmospheric pressure has been patented by Karl Marschall of Vienna, Austria.

United States Patent 3,733,268. Applied December 8, 1970. Issued May 15, 1973.
0182

Under this patent, a process and agents are provided for removal of both inorganic and organic contaminants from wastewater systems. These systems are treated with a phenolic aldehyde resin solubilized by alkali to effect removal of uranium salts and other inorganic salts such as phosphates, chromates, inorganic pigments; partially or wholly nonbiodegradable detergents such as alkyl benzene sulfonates and linear alkyl sulfonates; and organic materials such as decayed plant life, other nitrogen-bearing substances, phenol and phenol derivatives, and color-bearing matter.

Canadian Patent 925,633. Applied August 13, 1970. Issued May 1, 1973.
0183

TREATMENT METHODS AND FACILITIES

In 1963 four storm sewage tanks were constructed at Aldwarke sewage works, Rotherham, England, each 62 x 15 x 1.67 to 2 meters and equipped with a Mieder scraper and transfer carriage. In time it was found that these tanks were being used for less than ten percent of the time, which was a poor return on the capital investment, and that infrequent use was causing deterioration of the Mieder scraper and particularly of the electrical control gear and limit switches. It was concluded that the cheapest and most effective way of overcoming the problem would be to keep the tanks filled; consequently, final effluent was used for this purpose. The scheme involved pumping the effluent to the tanks but with the necessary penstocks and controls. When the sewage flow is less than 3 dwf, the first tank remains empty in readiness to receive the first flush of storm sewage when rainfall occurs. If and when the water level in the first tank reaches 0.3 meters below the sill of the outlet weir, electrodes in the tank actuate the mechanism which opens the penstock between tanks 1 and 2, closes the penstock in the diversion chamber, and stops the Spaans pump. Storm sewage then flows into tanks 2, 3, and 4, mixing with and displacing the final effluent in those tanks. When the rainfall has ceased and the flow has allen below 3 dwf, all the tanks are esludged using the Mieder scraper and he contents are returned to the works' nlet. After cleaning, tanks 2, 3, and are brought into use again as tertiary ettlement units.

ater Pollution Control, 72(1):87-90, 973.

0184

COMPUTERS AND SYSTEMS ANALYSIS

new computer system that is helping aton Rouge, Louisiana monitor the condi- ion of its sewer system on a 24-hour asis is cutting maintenance costs by ore than $20,000 a year. Using an auto- atic telephone dialing unit, the IBM ystem/7 computer places calls to tele- hone units which relay tone patterns enerated by sensors attached to 120 nmanned sewerage pumping stations hroughout the city. If the tone pat- ern indicates that a malfunction has ccurred, the computer identifies the rregular response and the type of mal- unction and prints a message to an perator telling him precisely what is rong at which station. This "Remote ontact Monitor Program" enables the com- uter to monitor the status of up to six ontact-point sensors at any location ith the proper telephone signaling quipment.

ater and Sewage Works, 120(4):57, pril 1973.

0185

or the past year, a minicomputer has ollected data from San Francisco's net- ork of rain gages and sewage level onitors in order to define the precise ink between the rain and the combined ewer overflows. The need for such data ustified the expenditure on the data cquisition system. It consists of 30 emote rain gage stations, 120 remote astewater level monitors, a central ecording station, and all necessary oftware to operate the system. The entral recording station includes a Honeywell H316 computer with 16,384 words of core memory, a real-time clock, and a power failure detection and power restarting unit. Its peripherals include two magnetic tape drives with a controller, and a teletypewriter. As a whole, the system is modular and flexible, and makes provision for its eventual expansion into the real-time control system.

Electronics, 46(11):114-118, May 24, 1973.

0186

Engineering Science, Inc. (E-S) of Arcadia, California, has prepared a computerized sewerage system master plan to predict sewer overloading and flooding, thus enabling the city to take preventive action. In developing the master plan, E-S and city personnel first determined the capacity of the existing sewerage system. They superimposed on this system patterns of anticipated growth. The computer calculated, sized, and prepared estimated costs of new or supplemental collection and interceptor sewers. The growth patterns included presently approved development, two other logical phases of growth, and the predicted ultimate growth patterns. The program consists of a design model and a cost model. Each can be manipulated easily to simulate any condition of development. Program output includes calculated peak flows and velocity, capacity of existing sewers, size, length, and cover, and invert elevations of recommended new sewers if required. After helping design the sewers, the cost model estimates construction costs. The master plan program can analyze up to 800 separate reaches of sewer. It is written in FORTRAN extended language for ease of application. The program is flexible and can be modified at nominal cost. It takes about 30 seconds to run the entire program and costs less than $40.

The American City, 88(5):96, 144, May 1973.

0187

Streamflow increased in southern Canada, in Alaska, and in much of the West, and generally decreased in the eastern and central States and in Hawaii during the month of May. Flooding continued throughout the month in the lower reaches of the Mississippi River and principal tributaries in Louisiana. Flow of the Mississippi River at Vicksburg, Mississippi, representing runoff from roughly 40 percent of the conterminous United States, was double the normal flow for the month. Flooding occurred also in many southeastern, midwestern, and western States. Above-normal streamflow conditions occurred in much of eastern and southwestern United States. A large area of below-normal flow persisted in the northwestern States, and smaller areas of below-normal flow occurred in the Dakotas, Florida, Texas, and Hawaii.

Water Resources Review, p. 11-12, May 1973.
0188

The Department of Buildings and Grounds retained Holzmacher, McLendon & Murrell, P.C., as environmental project consultants for an advanced wastewater collection and treatment center to serve a rapidly expanding county governmental center at Yaphank, Suffolk County, New York. Flow characteristics, coupled with severe effluent limitations set up by Suffolk County for discharge to groundwater aquifers, dictated a system utilizing the most recent state-of-the-art processes. For this project wastewater renovation for recycle to groundwater with the following characteristics was required: maximum effluent total nitrogen concentration of 10 mg/liter, means of equalizing the flow of influent raw waste, means to handle a 12-hour flow pattern, expansion from 250,000 gpd to an ultimate flow of 1.6 million gpd, and a total nitrogen concentration of 74 mg/liter. The process as designed meets all of the stipulated requirements with regard to effluent quality. At the same time, plant operation is simple with no stringent biological controls nor sludge recycle or mixed liquor concentration control required. Maintenance of dissolved oxygen levels is noncritical and control is not required.

Consulting Engineer, 40(6):108, June 1973.
0189

MATHEMATICAL STUDIES

Vortex pipe flow of suspensions with laminar motion in the fluid phase has been examined. The pipe consists of two smoothly joined sections, one stationary and the other rotating with a constant angular velocity. The flow properties of the fluid phase are determined by solving the complete Navier-Stokes equations numerically with governing parameters being the flow Reynolds number and swirl ration. Subsequent numerical solution to the momentum equations governing the particulate phase provides for both particle velocity and concentration distributions. The method can be applied to many other fluid flow or two-phase flow problems. It also provides an easy check on the results obtained by using some other approximated methods.

Journal of Applied Mechanics, 95E(2):331-336, June 1973. 22 refs.
0190

Linear proportional weirs are those weirs for which the rate of flow is proportional to the linear power of the head measured above the datum. Because of this characteristic these weirs find their use as flow measuring devices, outlets for sediment chambers, and controls for float-regulated dosing and chemical sampling. In the Keshavamurthy and Seshagiri generalized theory of proportional notches, the shape of the weir profile designed to maintain the linear relationship between the head and discharge are complex while being analytically sound. With a view to simplify the profile for purposes of practical application while maintaining the essential linear proportional quality, an experimental investigation was conducted utilizing a weir formed by two quadrants of a circle. It is shown that the quadrant plate notch can thus be used to obtain a linear proportionality between the head and discharge. This device has the advantage of simplicity of profile and is thus easy to construct, and in addition it does not have the restrictions imposed on some of the exact analytical profiles.

Water Power, 25(5):189-190, May 1973. 5 refs.

0191

ANALYTICAL TECHNIQUES

The use of ammonia selective electrode in the determination of ammonia in surface waters, sewage samples, and saline waters has been investigated. The electrode exhibited Nerstian behavior at a minimum concentration of 0.02 mg NH_3-N/liter in distilled water and 0.03 mg NH_3-N/liter in actual samples. When the values obtained for river and sewage samples were compared to those from the indophenol blue method on a Technicon Auto Analyzer, the results differed by an average of 1.2 and 4.6 percent, respectively. On river water samples, the known addition method was tested against direct measurement and found to be acceptable. In addition to being inexpensive, the ammonia electrode offers the advantages of minimal sample and reagent preparation prior to analysis, wide concentration range, precision and accuracy comparable to accepted methods, and speed (maximum of five minutes per sample).

Environmental Science and Technology, 7(6):523-526, June 1973. 4 refs.

0192

PATENTS

A piping renovation method utilizing a polyethylene liner drawn through with an oscillating motion has been patented by R. M. Bremner. An oscillating motion is set up by a cable attached to a pneumatic power unit, to which is secured the high density polyethylene lining tube, as they are drawn through the underground piping. Any residual friction inside the piping is overcome and damage to the lining prevented. The gap between the lining and the piping is filled with an embedding mortar to secure the lining in place.

German Patent 1,955,488. Applied November 4, 1969. Issued April 26, 1973.

Australian Patent 434,556. Applied October 15, 1969. Issued April 19, 1973.

0193

A novel flood protection system has been developed and patented by the Degussa Company in West Germany, consisting of 1-meter diameter hoses to be carried to the site of protection, unrolled, and filled as required. The hoses are made of a particularly tear-resistant fabric of endless "Trevira" fiber coated with polyvinyl chloride, have rot-proof surfaces, and when placed on uneven ground provide a quickly arranged and absolutely watertight barrier against flood waters rising to 60 centimeters. One 30-meter hose rolled up weighs about 100 kilograms and replaces 1100 sandbags. Emptied after use, the hoses can be reused. Damaged sections are repaired by welding or glueing; the hoses are resistent against chemicals, and therefore can be used as emergency containers for dangerous liquids.

Wasser, Luft und Betrieb, 17(5):165, 1973.

0194

A method and system of screening and simultaneously aerating wastewater, such as storm water overflow containing untreated sewage, is disclosed. The method involves one or more high-rate rotating screen concentrators wherein the influent is fed to the interior of a generally cylindrical, rapidly rotating screen. The concentrator is constructed to permit dispersion and atomization of effluent for increasing exposed fluid surface area and for improving contact thereof with air to increase the dissolved and/or entrained oxygen in the effluent. This may be accomplished by allowing a relatively unobstructed fall of the effluent out-wardly into a container, storage tank, or treatment or storage lagoon. The dissolved oxygen aids aerobic digestion and the entrained oxygen aids in frothing of the effluent for subsequent flotation and separation of fine solids and oils. The concentrated material which does not pass through the screen may be piped to a treatment facility.

United States Patent 3,739,912. Applied May 6, 1971. Issued June 19, 1973.

0195

A skid-mounted, jet-propelled, hydraulic pipeline cleaner which is activated from a stationary high pressure water pumping unit connected by a flexible hose has been assigned to the O'Brien Manufacturing Company of Chicago, Illinois. A novel skid arrangement of extreme rigidity, a selectively positionable water jet capable of assuming either a propelling position or a tool flushing position, and a jet propulsion system which is so designed that the jets produced thereby discharge directly into the pipeline void and do not impinge against any portion of the pipeline cleaner as a whole so that no retarding influence is offered to the free forward motion of the cleaner, constitute the salient features of the invention.

United States Patent 3,740,785. Applied July 14, 1971. Issued June 26, 1973.

0196

A flexible joint for sewer pipes, particularly clay pipes, for connecting a bell pipe section and a spigot pipe section, in which the bell section has an internal circumferential rib forming a support for the spigot end and upon which it may fulcrum during relative tilting movements of the sections has been patented by Ben B. Garrett of Whittier, California. The inner surface of the bell is relieved on one side of the supporting rib, and on the other side is formed with a groove for a sealing gasket of resilient deformable material, such as rubber, the groove having a peripheral space or cavity into which the gasket material can flow or expand under operating applied compression forces.

United States Patent 3,741,570. Applied November 16, 1970. Issued June 26, 1973.

0197

Equipment and methods for screening and concentrating wastewater overflow from combined sewer systems has been patented by Sweco, Inc., Los Angeles, California. Exemplary equipment includes a separator employing a substantially cylindrical rotating screen. Influent is piped upwardly into the equipment and deflected outwardly toward the inner surface of the screen in a manner to achieve a desired flow rate and flow pattern of the influent onto the screen. Means are provided for controlling the flow rate and for suitably directing the influent in a plurality of substantially discrete inclined streams toward the inner surface of the rotating screen. The screen is rotated at a speed to achieve a desired centrifugal force. Effluent passes through the screen to an outlet and the remaining concentrate passes to an outlet. The screen is in the form of a screen cage having a plurality of removable screen panels for facilitating replacement of damaged screens or changing of screen type or mesh size. Cleaning means is provided for directing a cleaning fluid periodically at the screen. The methods disclosed involve the manner in which the influent, effluent, concentrate and backsplash are handled, and the manner in which the influent is screened to achieve a fluid concentrate which is pumpable to other treatment equipment for ultimate disposal. Additionally, a sequence of influent feed and screen cleaning is described.

United States Patent 3,737,038. Applied June 3, 1971. Issued June 5, 1973.

0198

A patent for a refrigerated surge tank used to hold sewage at a reduced temperature and provide an aerobic digestion system with a regulated sewage feed is assigned to Richard J. Fletcher and Robert I. Fletcher of Greencastle, Indiana. There is no substantial loss of bio-nutrients nor the generation of offensive odors while the sewage is being held. Preferably the surge tank is also provided with means for oxygenating the held sewage.

United States Patent 3,737,382. Applied September 27, 1971. Issued June 5, 1973.
0199

COMPUTERS

In present optimization techniques pipe diameters are assumed to be continuous. At the end of the optimization process, the diameter is then rounded to the nearest available size, giving an approximate minimum at best, and possibly a nonfeasible solution. Thus a discrete optimization technique that treats pipe diameter as a discreet variable and flo and headloss as continuous variables has been formulated. It was applied to a fairly large water transmission system with good results. This technique can be used to design a completely new system as well as expanding one. Other pipe networks, such as oil pipeline and aircraft fuel systems, can also be designed by means of this technique.

Journal of the Hydraulics Division, ASCE, 99(HY 6):863-872, June 1973. 8 refs.
0200

Engineers have achieved significant reductions in construction costs of wastewater collection systems by the use of computers. Still greater cost savings can be achieved by improving the method of integrating pipes into a collection system with the technique of dynamic programming. Thus a new computer design which uses the conventional design constraints of minimum ground cover, critical invert elevations, and minimum and maximum velocities has been developed to establish a region of feasible solutions for each pipe. The integration, then, of each pipe into one collection system is achieved by the dynamic programming algorithm. Not only is the least cost design generated but a range of alternative discharge elevations and associated costs are made available. Solutions of realistic sewer design problems show that the least-cost design is produced by this system.

Journal of the Environmental Engineering Division, ASCE, 99(EE 3):333-345, June 1973. 5 refs.
0201

MODEL STUDIES

Models of four typical jet siphon type stilling pond storm overflows, the bypass being through an air regulated siphon, were tested. The main objective of the experiments was to reduce the saturation of the stilling pond with light solids. To obtain a comparison of the performance of different models, several hundred polymer beads of various densities were introduced into the upstream system of the overflow. The efficiency of the storm overflow, defined as the fraction of the solids not discharged through the bypass siphon, was then estimated and the influence of the location of the bypass siphon on the efficiency of the system investigated.

Journal of the Environmental Engineering Division, ASCE, 99(EE 3):177-185, June 1973. 5 refs.
0202

SEWER SYSTEMS

Superposition of two pipes in a common, mixed sewer system in Mulhouse, France is described. The risk of premature corrosion of concrete pipes due to effluents from recently connected hospital and dairy sources prompted their separation from storm runoff in the pipes. The effluents, diluted at a ratio of 1:3, are carried by the old, stoneware pipes located at the bottom of the sewer, while runoff has been switched to new concrete pipes of ovoid shape placed above the former. The upper duct, discharges to the collector at a given delay caused by a retention basin while the lower duct has direct passage to the old collector. Effluent separation makes it possible to convey all or part of the effluent to a wastewater treatment facility.

L'Eau, 68(4):173-174, April 1973.

0203

Since September 1972, a major project in Houston, Texas has been the insertion of a 36-inch plastic pipe in a 42-inch concrete sewer. This is the first time lining a sewer of this size had been attempted and there were many problems, such as sewer cleaning and inclement weather, associated with the operation. The pipe inserted is Mono-Line, furnished by Ryerson Plastics Division of Joseph T. Ryerson and Son, Inc. It is constructed of high-density polyethylene with an outer diameter of 35.433 inches and an inner diameter of 33.237 incheses and weighs about 51.4 pounds per foot. It is shipped in 39-foot sections. Generally, the sections were joined above ground in the desired lengths, using a heater plate for welding. When sections were joined underground, joints were made with Dresser couplings and stabilized sand employed to surround the joints. A total of 2000 feet of concrete line was rehabilitated in the project. The first insertion amounted to 1750 feet. Special equipment was devised to permit pulling the pipe very slowly using a 7/8-inch cable and a 600 to 1 geared cable drum. Inverted nose cones were inserted in both ends so that assembled sections would be pulled in either direction as required. Jacks were then erected at manholes to reinforce the structures against the pulling force. The pipe was supported during the operation by a sling from a crane mounted on a tractor. Pipe ends were equipped with casters to ease sliding of the insertion sections in place.

Public Works, 104(6):98-99, June 1973.

0204

The installation of over 5000 feet of storm drain as part of a drainage system for a 150 home subdivision in Rochester, Michigan required more than 50 manholes and a considerable amount of excavating and backfilling work. The entire project was completed in just 24 working days averaging 200 feet per day which included excavating, pipelaying, and backfilling. Trenches were formed to a depth of eight feet and a width of six feet to provide ample room for the corrugated metal pipe specified for the installation. The pipe ranged from 12 to 42 inches in diameter. The Ray W. Malow Company of Utica, Michigan used a Poclain RC-200 excavator in the project.

Excavating Contractor, 67(4):28, June 1973.

0205

A Canadian contractor is installing paper drains instead of sand drains for the first time on a North American construction job. A Japanese-built rig that works much like a sewing machine is placing the paper drains, at a rate of 1.5 per minute, to dewater and consolidate earth below a highway embankment near Trois Rivieres, Quebec. The $350,000 contract calls for installing 8000 vertical drains to consolidate a layer of mixed silt, clay, and sand for a two-mile road section. The 4 x 1/8-inch paper strips are impregnated with arsenic salt to slow bacterial action and with melamine resin to increase their wet strength. Once in place, water is forced upward through ten small tubular channels between the outside glued faces of the drains by the weight of the embankment. Tests on other job sites in Europe and Japan show that the paper drains produce faster consolidation at a lower cost than conventional sand drains.

Engineering News-Record, p. 17, June 7, 1973.

0206

The mainland area of Halifax, Nova Scotia was developed without storm sewers and without adequate provisions for surface and groundwater runoff. As a result, an abnormal amount of water infiltrates the sanitary sewer system through structural defects in sewer pipes and illegal storm sewer connections. Because of this situation, the sewer system has become overloaded to the point of flooding existing homes. System overloading has also prevented development of approximately 4000 acres of land. To alleviate both problems, smoke testing was employed to locate sources of infiltration and illegal storm connections. Equipment consisted of a portable 1500-cfm Homelite blower with a canvas air duct; a plywood manhole cover lined with 3/4-inch thick sponge rubber for connection to the canvas duct; and sheetmetal elbows fabricated to provide for an inlet smoke tube and to connect the canvas air duct from blower discharge to manhole cover. In typical operation, sections of each sewer were insulated by sand-bagging the sewer manholes in such a way that a limited volume of sewage could still flow. Next the blower was started, a smoke bomb placed near the intake vent and lighted. The smoke, drawn into the intake, was forced into the manhole and sewer. Not a true smoke, the high-moisture zinc chloride used in testing created a dense, grayish white or white appearing mist; its exact color depending on density and lighting, the smoke left no residue.

Water and Pollution Control, 111(6):23-24, June 1973.

Water and Pollution Control, 111(6):20, June 1973.

0207

Storm runoff pollution measurement in sewer systems conducted in Cincinnati, Tulsa, Ann Arbor, and in Oxhey, England as well as measures for pollution abatement of water bodies have been investigated. The filtrable matter content and dissolved solids content of said runoff in Tulsa ranged from 84 to 2052 mg/liter and from 89 to 400 mg/liter, respectively. The BOD_5 and COD values of the runoff in Cincinnati, Tulsa, Ann Arbor, and Oxhey were in the ranges of 8-28 mg/liter and 42-138 mg/liter. The soluble orthophosphate content and the organic nitrogen content average 0.54-3.49 mg/liter and 0.36-2.10 mg/liter. This runoff pollutant load can be effectively reduced by intensified street clean-up, especially in March and April, and by global air pollution abatement. A Cincinnati experiment with storm water retention for 10 to 20 minutes in a retention basin gave results concerning (mediocre) pollutional load abatement, (no) effect on bacteria count, and (fairly high) investment and operating costs. The rates of reduction in the BOD_5 value, the organic nitrogen, and total phosphate contents achieved after retention of 20 minutes in the four systems were 15, 33, 25, and 8 percent.

Gas-Wasser-Abwasser, 53(4):109-113, May 1973.

0208

TREATMENT METHODS AND EQUIPMENT

The largest known installation of polyvinyl chloride trickling filters for wastewater treatment is to be completed by December at Stockton, California. Nearly 1.5 million cubic feet of B. F. Goodrich Koroseal Vinyl Core filter media will be required to fill three towers, each 22 feet high and 166 feet in diameter. The new towers will take the place of three rock media filters in an expansion and upgrading of the main municipal water pollution control plant at Stockton, which treats both municipal and industrial wastewater. The project designed by Brown and Caldwell Consulting Engineers of San Francisco, will be undertaken by Lomar Construction of Santa Ana, California.

Public Works, 104(6):106, June 1973.

0209

A prototype of a packaged sanitary wastewater treatment system employing physical-chemical processes has been evaluated for its ability to remove and inactivate enteric viruses. The treatment system, consisting of comminution, chlorination, activated carbon adsorption, alum flocculation, and vacuum filtration using diatomaceous earth as a filter aid, was designed for a variety of situations where conventional biological treatment is impractical. Both simulated marine sewage and simulated river water to which vaccine strain type 1 poliovirus was added as a marker were used as influent wastewater. The treatment system was capable of reducing the total amount of virus in the wastewater from about 99.96% reduction when marine sewage was processed, and from over 99.9996% reduction when simulated river water was processed. However, about 2.6% and 0.16% of the total influent virus was detectable in filter cake solids from raw sewage and from simulated river water, respectively. The degree of virus reduction in the treatment system is superior to that obtained in conventional primary and secondary wastewater treatment.

Journal of the Environmental Engineering Division, ASCE, 99(EE 3):245-252, June 1973. 19 refs.

0210

The South African Inventions Development Corporation has granted an exclusive licence to Orbal Purification (Pty) for the exploitation of the Orbal Sewage Purification System in Southern Africa. The system is based on the principles of the activated sludge process and produces a well-stabilized sludge as well as a high-purity effluent. Owing to the exceptionally low nitrogen content, the effluent is suitable for reclamation. The cost of sewage treatment using the Orbal System is lower than that of conventional systems, due partly to inexpensive construction and maintenance and simplicity of operation.

Die Siviele Ingenieur in Suid-Afrika, 15(1):28, January 1973.

0211

Studies made for the Ichihara City drainage pumping plant which is now in the design and construction stage, were based on a cost-down achieved by increasing the rotation speed of the pumps. The system is to be constructed on a general theory concept and adjusted to the actual conditions of the site with the plant being able to treat both storm runoff and sewage. Screw pumps are to be used on one level and the limit of lift head determined by the level of elevated water. The rain quantity, rain runoff, and sewage simulation systems will be constructed with the initial cost and the running cost calculated from the first year expenses. An optimum system designed by comparing the costs of various combinations of high rotation pumps and base pumps of various mouth sizes was determined to include nine high rotation pumps with 3000 mm diameter mouths and two combination pumps of high rotation and base pumps.

Gesuido Kyokai-shi, 10(108):24-40, May 1973.

0212

Monmouth County, New Jersey is sending its sewage 4000 feet into the Atlantic Ocean to a 640-foot long submerged diffuser. The new underwater outfall will tie more than a dozen communities, three sewer districts, and three treatment plants into the Monmouth County Bayshore Outfall Authority's system. The outfall, 5360 feet long, is being constructed of steel pipe provided by Bethlehem Steel Corp. For the river section, the 48-inch pipe is lined and coated with coal tar enamel and double felt wrapped. For the ocean section, the pipe is lined and coated with two coats of epoxy. A concrete coating is sprayed on the outside to facilitate sinking the pipe into position. Assembled on a specially designed rubber-wheeled conveyor track, the pipe lengths are welded into 600-foot sections. Joints are bell and spigot double lap-welded.

The American City, 88(6):96, June 1973.

0213

Along with rehabilitation of Alcoa, Tennessee's two 50-year old hilltop reservoirs, the city had covers installed to check loss by evaporation, reduce chlorine depletion due to sunlight, and cut the potential for pollution. The covers, manufactured by Burke Rubber Co., San Jose, California, consisted of a 5-ply, 45-mil sandwich of *Hypalon*, a product of Du Pont, Inc., and nylon reinforcing fabric. This synthetic rubber/nylon sandwich is resistant to sunlight and weathering, mold, mildew, and fungus. Of particular importance in this application, the cover is resistant to chemicals required for water treatment. For installation, the rubber sheets arrive at the site in accordion-folded rolls packed on pallets. The rolls are positioned in their programmed locations at the top of the reservoir slope, unrolled to the bottom, and unfolded to full width. Next, 4 x 12-inch plastic foam planks are placed into their flotation sleeves and seamed. These planks provide the cover with stabilization and flotation as well as channel rainwater runoff to the periphery. Once the cover is secured in place, a foot of water/chlorine solution is admitted to the reservoir to treat the floor of the area and the underside of the cover against bacterial contamination. When this solution is drained, the reservoir is gradually filled, and placed in service.

The American City, 88(6):33, June 1973.
0214

A new treatment method using oxygen instead of air for the supply of aerobic bacteria in the activated sludge process is entitled UNOX. The UNOX oxygen entry system, requires a series of inter-connected gas-tight chambers closed on top and an even distribution of activated sludge over the chambers to achieve a 90 percent use of the oxygen. Oxygen is supplied to the first low pressure chamber, drawn on by means of compressors installed on top of the chambers, and transported into the sludge through a hollow agitator axle. Eight perforated arms are installed through which the oxygen may leave. This process is repeated in successive chambers. Each chamber has its own gas circulation maintained by the compressors. Since oxygen is constantly consumed by the water-sludge mixture and carbon dioxide is produced during the decomposition processes, the oxygen concentration drops from chamber to chamber until only 40 to 50 percent remains with spent gas escaping to the atmosphere. Experimental plants operating on the basis of the UNOX method have been constructed in New York, Ohio, and Louisiana. In the Cincinnati plant, a BOD reduction of 91.4 and 96.1 percent was measured for residence times of 2.2 and 2.8 hours; COD dropped by 77 and 84 percent; and, sludge concentration increased to 8.8 g/liter with an oxygen concentration exceeding 6 mg/liter.

Muechner Beitraege zur Abwasser-, Fischerei- und Flussbiologie, 22:109-124, June 1973. 24 refs.
0215

The 826 km of pipelines utilized by 700,000 people in the four districts of the Osaka Municipal Government are serviced by a maintenance force of 109. Continuous monitoring of conditions and data collection are two of the aims, yet problems are mounting with the constant increase of sewage and the deterioration of the lines. In 1971, high pressure cleaning cars dredged 29.719 meters of pipes which is less than 10 percent of the total length. Accordingly, the dredge work maintenance is concentrated on the most problematic areas. Sludge and mud collected manually or by machine are treated by a grid collector and used for landfill. Improvement plans include replacement of the old pipeline system, the use of anti-corrosive pipes for factory areas, periodic dredge work and leveling of pipe systems where possible, installation of bypass pipes for congested areas, regular inspection and dredge work of storm runoff drainage pipes, and installation of new branch pipelines.

Gesuido Kyokai-shi, 10(108):41-56, May 1973.
0216

A compact sewage treatment installation, designed for complete biological treatment of sewage in small communities, vacation establishments, hotels, or small industrial sites, has been produced in Czechoslovakia in four sizes with 25, 40, 65, and 93 cubic meters nominal tank volume. The easily mounted and transported system has a rectangular steel container for the frame installed on a concrete plate and is comprised of three parts: a dry intake space with a slotted drum rack, an activation space aerated through a shaft, and a settling space with a resettable overflow chute. Protected by an overhead roofed service platform, the system includes automatic control, a heater, an auxiliary transformer for portable lighting, and a 220 v transformer for electric drive equipment. In the activation space, the sewage is circulated under intensive aeration, and organic matter gradually mineralized. The sludge must be discharged periodically.

Wasserwirtschaft-Wassertechnik, 23(3):105, 1973.
0217

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 9 September 1, 1973

A 1971 investigation of Japan's public water quality resulted in the following published information. Samples for the examination of toxic matter were collected at 1966 locations, and those for the living environmental standard were collected at 1253 locations including 330 rivers, 9 lakes, and 68 sea locations. Toxicity was analyzed in 89,074 test samples with 0.6 percent failure to pass the acceptable quality standard; in 1970, the failure percentage was 1.4. As in 1970, cyanogen (1.2%), cadmium (0.7%), and lead (1.4%) were the elements that had highest failure rates. Other major toxic substances were alkyl mercury, organic phosphorus, chromium, arsenic, and total mercury. In the examination of the living environmental standard, 22.6 percent of the 76,757 samples failed to meet the standard. For rivers, 30 to 70 percent failed to meet the standard BOD level and 50 to 70 percent of the samples failed to pass the standard for presence of coli baccilus. 43.9 percent failed to pass the standard for lakes and ponds. Of the 15,960 sea water samples, 17.6 percent failed to meet the COD standard.

Kankyo Gijutsu, 2(1):14-21, January 1973.
0218

During the period from January to July 1972, six municipal sewage treatment plants were monitored for the efficiency of heavy metals removal. Composite samples from several locations within each plant were analyzed for cadmium, chromium, copper, zinc, and lead. The efficiencies for the removal of each metal from each plant were studied. The results of this study show that chromium, copper, and lead were more efficiently removed in secondary treatment processes than in primary processes. Chromium is reduced during aeration in the secondary process, copper is strongly adsorbed by the microbial floc, and lead is removed more efficiently because of increased settling time and larger particle size in secondary treatment. Zinc was removed equally well from all plant types. Removal correlations for cadmium could not be made. The results from the six plants in this study indicate that a definite advantage of a secondary treatment plant over a primary treatment plant in heavy metals removal is the increased suspended solids (SS) removal. This increased SS removal results in an exponentially increased heavy metals removal.

Environmental Letters, 5(2):104-114, 1973.
9 refs.
0219

The distribution of inorganic phosphorus in different size fractions of domestic and municipal sewage has been examined. Fractionation of the samples was carried out by cellulose membrane filtration. Total phosphorus, inorganic phosphorus, and organic phosphorus content of the samples was determined before fractionation, in the < 3μ suspension and in the < 0.025μ suspension. The phosphorus contents in the > 3μ solids and 0.025 - 3μ solids also were calculated. For both samples, the organic phosphorus content was about 10 percent of the total phosphorus in the < 0.025μ suspension, with inorganic phosphorus making up the remaining 90 percent. The percent distribution of inorganic phosphorus in the > 3μ solids, 0.025-3μ solids, and < 0.025μ suspension of the samples ranged from 19-29, 0-8, and 63-81; that of organic phosphorus ranged from 56-72, 7-17, and 21-27 percent. For the two sewages tested, the following phosphorus removals may be expected: 17-24 percent removal by plain sedimentation - 60 percent removal of suspended solids; 32-45 percent removal by coagulation, flocculation, and sedimentation - 95 percent removal of suspended solids and colloidal solids; 89-90 percent removal of phosphorus precipitation, coagulation, flocculation, and sedimentation - 95 percent removal of total suspended solids, total colloidal solids, and dissolved inorganic phosphorus; and, 39-41 percent removal by primary plus secondary treatment. Tertiary treatments such as precipitation, filtration, and adsorption, when used in suitable combination, can increase total removal to about 99 percent, leaving 0.1-0.2 mg/liter phosphorus in the final effluent.

Water & Sewage Works, 120(5):82-83, June 1973. 7 refs.

0220

HYDROLOGIC ASPECTS

The collection of rainwater from natural and artificial runoff surfaces for drinking and irrigation is an ancient practice, especially in regions experiencing slight rainfall. Australia is one of the foremost pioneers of recent times in developing this form of water gathering. One method still in use after 40 years in the State of Victoria makes use of overlapping galvanized iron sheeting butted together. The iron-clad runoff surface has several advantages; the area over which it is to be laid requires relatively little preparation, the surface is assembled cheaply and easily, and requires little maintenance. The capital outlay for this equipment is high, but once assembled the cost of water collection compares well with other artificial runoff systems. Bituminous runoff surfaces are widely used in western Australia where the preparation of bituminous runoff surfaces is similar to that for the construction of light roads and for this reason the method is limited to areas where the necessary construction facilities are available. Bituminous surfaces are in time vulnerable to cracking and vegetative attack, thus resealing is normally necessary every six to ten years. Runoff collection systems being tested, primarily in the United States, for future use include: 1) cementing in a single machine operation an aluminum foil skin to the underlying soil with asphalt showed no sign of deterioration after five years; 2) spraying asphalt emulsion or cutback asphalt onto the soil, covering with unwoven fiber glass, and coating with undiluted asphalt emulsion; and, 3) depositing gravel on a plastic sheet which in turn has been laid on a prepared soil surface. In this last method, rainwater percolates through the gravel and is retained by the sheet thus affording a 60 percent runoff collection.

South African Journal of Science, 69(3): 77-78, March 1973. 15 refs.

0221

In a two-year test series conducted in West Germany, the runoff conditions specifically related to mixed sewer systems were determined during rainfall periods. Quantitative measurements were taken for 621 storm runoff periods with intensities greater than .7 ft^3/sec. Samples were taken in such short intervals that evaluation of the dirt load was feasible. Primary runoffs which flushed entire sewer systems, runoffs which succeeded primary runoffs, and runoffs which partly flushed the sewers, were considered. The results indicate that only temporary storage of the storm runoff and its subsequent purification help to reduce the dirt load. For maintaining a dirt load consistent with that occurring during dry weather, no water may pass the rain storage basin after it has been filled. Under present conditions the dry weather runoff goes directly to the purification plant and the storm runoff directly to the receiving stream without treatment.

Berichte der Abwassertechnischen Vereinigung E.V., (25):97-115, 1973. 11 refs.

0222

A technique whereby a synthetic record of monthly runoff may be generated for any British catchment, gaged or ungaged, has been developed. The technique involves the simultaneous stochastic generation from readily available data of monthly values of catchment precipitation, potential transpiration, and snowlag, which are then routed through a simple deterministic catchment model to yield the corresponding synthetic record of monthly runoff. Numerical values of the model parameters are obtained from a correlation with the topography, geology, and soil type of the catchment under investigation. The technique is intended primarily for use with high-speed electronic computers. A computer program incorporating both deterministic model and stochastic data generation procedures is used, enabling a semi-infinite synthetic catchment runoff record to be obtained.

Journal of the Institution of Water Engineers, 27(3):149-162, May 1973.
12 refs.

0223

A recent test of the accuracy of snowmelt prediction equations using data from an index snowmelt plot produced predictions that deviated significantly from measured values on days with high melt rates and during periods of rainfall. Since the index snowmelt plot presumably measures melt accuracy, a method by which daily collected snowmelt can be used to forecast basin runoff during significant snowmelt events was devised. Since mean daily rates of snowmelt runoff depend strongly on antecedent snowmelt and runoff, the method of least squares coupled with an accumulation procedure produces high correlations between accumulated runoff and accumulated snowmelt. Thus both mean daily flows and daily volume can be forecast for a basin during a snowmelt event. This method also appears useful for extended runoff forecasts based on the amount of snow remaining at a snowcourse sampling site. These extended forecasts can be made with greater accuracy than one-day forecasts. As a snowmelt collection device, the universal surface precipitation gage developed at the Northwest Watershed Research Center, Boise, Idaho, was used. This gage continually assesses the water equivalent of the snowpack concurrently with the rate of water flow from the base of the snowpack.

Journal of Soil and Water Conservation, 28(3):131-134, May/June 1973. 5 refs.

0224

CONSTRUCTION EQUIPMENT AND MATERIALS

A Vienna contractor has concreted a sewer duct 26 feet below grade in Vienna, Austria using an airbag to increase the pouring rate up to 80 percent over conventional forming methods. The duct, resting on a concrete slab poured in a trench, has walls that vary from 7 to 13.5 inches thick, and a roof 9.75 inches thick. The inflated airbag, over which concrete is poured in 33-foot sections, is 41 inches high and 27 inches at its maximum width. Internally, the airbag consists of two separate systems of cells and tubes, one inflated to 7.1 and the other to 1.4 psig. The lattice structure and the two air pressures combine to maintain the bag's egg-shaped height and width ratio under load. Airbag setup time for a 33-foot duct section averages eight feet per hour compared with 1.5 feet per hour with conventional wood formwork and just under 2 feet per hour with steel forms. Cost of the airbag forming system is about $1.80 per yard. Life of the neoprene-coated multilayered bag is expected to last beyond pours of 33,000 feet. The airbag system, called Pneumo-Falsework, was engineered by Dr. Franz Gebauer of Neue Reform Baugesellschaft. Semperit A.G. of Vienna manufactures the bags in eight sizes. Cross sections vary from 29.25 to 70 inches high and the widest horizontal dimensions range from 19.5 to almost 47 inches.

Construction Methods and Equipment, 55(7): 129, July 1973.
Engineering News-Record, 191(3):36, July 19, 1973.

0225

Cooling water piping for the first unit of the new power generation station on the bend of the Mississippi River at New Madrid, Missouri, posed several unique engineering and construction problems. Therefore, heavy core, double prestressed concrete subaqueous pressure pipe was specified - pipe designed to take a three-edge crushing load of 855 kg/linear centimeter. With unusual river conditions the pump structure was treated as a separate unit and installed on land at the shore end of the subaqueous pipe. The intake structure was then fabricated on land and sunk into position after the pipe was laid. Standard 3.04-meter prestressed concrete pressure pipe was used from the pump structure to and from the main generating complex to the sealing weir and outfall. A 2.13-meter diameter branch line also was installed for future use.

World Construction, 26(5):50, May 1973.
0226

A method of prefabbing and setting more than 650 sections of pipe required a highly mobile casting system able to advance continuously with the job as well as an intricate transport system to lift, tilt, and carry the sections to the trench for placement. Most of the pipe sections weighing 61 tons are almost 20 feet long and over 16 feet in diameter. They are cast vertically in pairs with cylindrical rebar cages encased by semi-circular steel forms. At their base, forms are socketed into portable rings of concrete and steel laid on solid ground between parallel lines of sheet piles. Two prefabbed pipe sections requiring 27.5 yards of concrete are poured each day by crane and bucket. A specially designed strongback-type rig handled by two 50-ton Portoli gantry cranes lifts, tilts, and then holds a pipe section horizontally while the cranes carry it to the trench for setting. The cranes work in tandem, traveling an average of 560 feet over rails laid outside the lines of sheet piles. Each pipe section is landed on two 3.25- by 10-foot semi-circular concrete blocks prefabbed on-site. The blocks, in conjunction with tongue-and-groove fixtures cast integrally with the pipe, position and join adjacent sections. After the sections are tie-bolted together, their alignment fixtures are concreted. The $2.2 million twin duct is part of a sewage treatment plant under construction for the City of Vienna, Austria.

Construction Methods and Equipment, 55(7):114-115, July 1973.
0227

In-place renovation, which effectively restored the original flow characteristics and performance of 2910 feet of 42-year-old transmission and distribution pipelines, has been accomplished at the Los Angeles Coliseum. To do the job, the Coliseum Commission called in a team of seven men from the Ameron, Inc. Pipe Lining Division of Wilmington, California. To gain access to the pipelines, nipples were cut to accept the half-inch steel cable and the cleaning and lining apparatus. The lining was installed with Ameron's "Spunline" applicator, pressure fed to ensure uniformity of coating. Hoses through which the mortar was pumped were elevated up to 50 feet and extended as long as 350 feet from the mixing units located at ground level outside the coliseum.

The American City, 38(7):42, July 1973.
0228

1700 feet of 40-inch diameter nylon-reinforced plastic pipe that left a Japanese factory in a soft, coiled condition and was flown to the United States, was fed into a heating device carried behind a truck and emerged fully hardened and prepared for service. The pipe is adaptable for water transmission and certain water distribution systems, especially for longer pipe runs. Constructed of a special compound polymer and high tensile synthetic yarn, Takata H. F. pipe is said to be capable of being manufactured at strengths up to 300 psi. It is made and installed in essentially endless lengths. The pipe is claimed to be economical and competitive.

Water and Wastes Engineering, 10(7):13, July 1973.
0229

Installation of vibrated bin activators eliminated a major obstacle to the successful operation of a new automated chemical storage and feeding facility at the Potomac River Water Filtration Plant of the Washington Suburban Sanitary Commission, Montgomery County, Maryland. To insure uninterrupted flow of the alum and lime, consulting engineers Whitman, Requardt and Associates specified installation of a seven-inch diameter Vibra Screw bin activator on each storage bin. Material is drawn from the bins into gravimetric feeders. The bin activators are flexibly hung from the bin by rubber fitted, forged steel hangers. A flexible reinforced rubber sleeve seals the small gap between the bin and the movable bottom. An integral baffle relieves headload over the discharge outlet. Mounted on the bin activator, and riding with it, is a patented oil lubricated gyrator. The vibratory action of the Vibra Screw bin activator has completely eliminated flow stoppage. Consistent flow of lime and alum to the feeders has enabled then to maintain an accuracy of within one percent of the set rate.

Water and Sewage Works, 120(7):49, July 1973.

0230

PATENTS

A process for dewatering sludge, particularly for dewatering sludge in sewage treatment plants, by means of filter presshaving belts has been patented by Albert Bahr. The sludge is conveyed around a drum between belts, both of which pass around the drum, with the sludge being squeezed between the belts as it is conveyed around the drum by the belts.

United States Patent 3,743,100. Applied June 7, 1971. Issued July 3, 1973.

0231

Equipment and methods for screening and concentrating wastewater overflow from combined sewer systems are disclosed. Exemplary equipment includes a separator employing a substantially cylindrical rotating screen. Influent is piped upwardly into the equipment and deflected outwardly toward the inner surface of the screen in a manner to achieve a desired flow rate and flow pattern of the influent onto the screen. Means are provided for controlling the flow rate and for suitably directing the influent in a plurality of substantially discrete inclined streams toward the inner surface of the rotating screen. The screen is rotated at a speed to achieve a desired centrifugal force. Effluent passes through the screen to an outlet and the remaining concentrate passes to an outlet. A certain amount of the influent splashes from the inner surface of the screen, and is received by a backsplash pan and may be recirculated and rescreened. The screen is in the form of a screen cage having a plurality of removable screen panels for facilitating replacement of damaged screens or changing of screen type or mesh size. Cleaning means is provided for directing a cleaning fluid periodically at the screen.

United States Patent 3,743,094. Applied December 20, 1971. Issued July 3, 1973.

0232

A sewage treating system and method particularly suitable for installations with highly variable flow provides automatic operation in which incoming sewage is mixed and aerated continuously and withdrawn in batches for clarification and discharge. A sewage receiving basket having open mesh side and bottom walls is partly submerged in mixed liquor in an aeration chamber. Mixed liquor is mixed with air utilizing venturi aspirated atmosphere into a pump suction and circulated in this chamber. A portion of the aerated mixed liquor is circulated through the basket to cause aerobic digestion and hydraulic erosion such that there is a reduction in size of the solid organic material in the basket to particles which will pass through openings in the walls of the basket and intermix with pre-existing mixed liquor. Batches of mixed liquor are intermittently pumped from this chamber into a settling chamber in excess of the amount filling the settling chamber. The excess is discharged back into the aeration chamber over a weir and acts to skim floating sludge back into the aeration chamber. The resulting batch thus withdrawn from the aeration chamber is settled in the settling chamber under quiescent conditions; a part of this settled batch, specifically supernatant liquor taken from below the top scum layer, is then delivered to a discharge chamber where it is further settled and the resulting supernatant liquor discharged. Settled sludge and floating scum from the settling and discharge chambers are returned to the aeration chamber by pumps which completely empty these chambers.

United States Patent 3,746,638. Applied March 3, 1971. Issued July 17, 1973.
0233

A patented self-contained package sewage treatment plant includes an annular aerobic, biological treating channel into which raw sewage is fed and continually driven around the channel by a plurality of rotating perforated discs which also function to aerate and agitate the contents of the channel. A central, sludge tank is located within the space defined by the channel, and controlled recirculation of activated liquid from the settling tank to the annular channel is effected by one of the discs. The clarified effluent from the settling tank is taken from a weir trough adjustably mounted in the upper portion of the sludge tank.

United States Patent 3,744,634. Applied February 25, 1971. Issued July 10, 1973.
0234

A patented device for separating solids and other foreign bodies from liquids in a pipe conduit includes a screen mounted in the conduit which is conically tapered in the flow direction. A discharge tube for the separated solids, leading to the outside, is connected at the apex of the screen. A barrier is arranged on the outer side of the screen which extends perpendicularly to the surface of the screen between the individual rows of holes of the screen.

United States Patent 3,747,771. Applied December 22, 1971. Issued July 24, 1973.
0235

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

The feasibility of using coliphages as indicators of sewage pollution has been investigated. Standard coliform determinations (MPN) also were made to compare fluctuations in coliforms with fluctuations in their obligate parasites. No consitent relationship was found between coliform and coliphage levels. The results indicate, however, that the enrichment method of phage assay can be used for the detection in water of low levels of phages active against specific host bacteria.

Canadian Journal of Microbiology, 19(6): 747-751, June 1973. 15 refs.
0236

The Municipality of Metropolitan Seattle (Metro) which has the responsibility for wholesale collection and treatment of storm water and sanitary sewage in the Seattle metropolitan drainage basin, is pioneering the use of ultrasonics for level measurement and control in the sewage industry. Ultrasonic level measuring systems, designed and manufactured by Western Marine Electronics (Wesmar) of Seattle, have been installed in two of Metro's six treatment plants, at the north trunk interceptor and in a pumping station. The level monitor is a non-contacting continuous measuring system. Each system is comprised of two basic components, a sensor and a solid-state electronics unit interconnected by coaxial cable, capable of operating at distances up to 500 feet apart. The sensor, mounted above the material to be measured, is a combination sonic transmitter-receiver. It emits an ultrasonic signal onto the target and the echo is reflected and detected by the same sensor. The signal is then transmitted through the coaxial cable to the electronics unit, where the time interval between transmission and reception is computed. This time computation is converted to a continuous electrical output which is in turn displayed on a meter in engineering units or fed to process control equipment or recorders.

Water and Sewage Works, 120(5):84-85, June 1973.
0237

Encouraging results have been gained during a three-month operation in an activated sludge basin using a Zuellig type oxygen sensor, developed by Jaag, Hoerler, and Kalman. The device, especially suited for long-term measurement of the oxygen content in activation basins, is operated according to the Toedt principle, providing polarization current between two different noble metals in an electrolyte solution. The magnitude of the polarization current is determined by the oxygen content of the medium. The probe is composed of a plastic tube with two metal rings (electrodes) at its lower extremity, which are continuously cleaned by a rotating grindstone. The probe is splash-proof, non-corrosive, and permits nearly maintenance-free, long-term measurements even under rough working conditions.

Wasser- und Abwasser-Forschung, 6(3):93-94, 1973.

0238

TREATMENT METHODS AND FACILITIES

The Lovoe-type flocculation and sedimentation basin in Sweden has been improved by incorporating the following changes. Sludge drainage through bottom valves, which requires a long time and provides sludge with a low dry content, has been replaced by perforated tubes mounted on wheels which are moved back and forth, over and underneath the intermediate bottom in a flow direction for sludge suction. Sludges with a dry content of two to three percent can be tapped gravitationally, while such with higher dry content need pumping. Sludge tapping, its frequency and duration are chosen as a function of the dry matter content in the sludge. The bacteria count in decantates from sedimentation basins with this sludge drainage system did not differ from that in decantates from conventional basins. No chlorination is applied in the flocculation and settling stages.

Kemisk Tidskrift, 85(5):46-48, May 1973.

0239

The first stage of a Canadian project to recycle sewage and refuse from high population density housing communities has been completed with the construction of a wastewater renovation plant. Second stage of the project, addition of a heat recovery incinerator to dispose of the sewage sludges and domestic refuse, making the system largely self-sufficient, is expected to be completed this fall. Application of the Canwel (Canadian Water Energy Loop) packaged process offers the following advantages: provides a permanent economical solution to the need for clean water and waste disposal service in every community; eliminates water pollution; eliminates the present need of water and sewage lines to service housing developments; and, provides service where the conventional water treatment systems are impractical. The solid waste treatment pilot plant under construction, a modified Trecan unit, will incinerate the accumulations of sludge together with unreclaimable household refuse while utilizing the heat to produce a hot water supply and evaporating water from the sludge in preparation for incineration. It will be integrated in a closed cycle with the wastewater renovating subunit to complete a self-contained operating model of the Canwel system.

Modern Power and Engineering, 67(6):42-43, June 1973.
Canadian Chemical Processing, 57(6):41, June 1973.

0240

Black, Crow & Eidsness has designed an activated sludge process as Boca Raton, Florida's new 10 mgd wastewater treatment plant which can be operated as a contact stabilization or a completely mixed system. The sequence is aeration-final settling-chlorination, with aerobic digestion of sewage solids. The resulting sludge is decanted, then concentrated to ten percent solids in a basket-type centrifuge. Thickened sludge is trucked to a sanitary landfill. Sludge from the city's adjacent water softening plant is vacuum filtered at the wastewater treatment plant. The cake, containing 65 percent solids is trucked off the site and used as a road building base. Treated effluent is chlorinated at the plant and rechlorinated three miles away at the Atlantic Ocean beach before discharge (one mile from shore in 90 feet of water through a 36-inch diameter cast iron outfall).

Water and Sewage Works, 120(5):65, June 1973.

0241

The Chiba Municipal Sewage Treatment Plants comprise three major districts serving a combined population of 1,275,000. The Central Treatment Plant construction was started in 1965 and the entire plan is being completed in three stages. Presently in the final stage, the installation of a sludge treatment system is under construction. The treatment capacity is planned for 110,760 m^3/day, but presently treats only 71,140 cubic meters in dry weather and 83,400 during rainfall. The effluent has a BOD of 200 mg/liter and suspended solids of 300 mg/liter with removal percentages of 92.5 and 89.0 respectively. The sewage effluent enters the receiving pond, where the pressure distributes the water into three settling ponds. The settled sludge is sent to the sludge relaying system and goes to the sludge concentration tank and to the digestion tank; the exhaust gas is sent to the gas tank and is used as a boiler fuel. The sludge is finally washed, dehydrated, and incinerated. The supernatant water from the first settling tanks goes to the aeration tank where the high pressure air from the blower helps oxidize organic matter and water quality is stabilized. The final settling tank next settles the activated sludge mixed in the aeration tank and returns the sludge to the aeration tank. Chlorine is added for disinfection. Treatment water is cycled to the water tank or discharged to the ocean.

Gesuido Kyokai-shi, 10(109):53-62, June 1973.

0242

A two-hour laboratory test has shown that a simple process involving a metal catalyst, ozone injection, and ultrasound, can remove 42 percent of organic carbon materials left in wastewater after it has already gone through the primary and secondary treatment stages. These results came from using a standard catalyst called Raney-Nickel, in combination with ozone and ultrasonic irradiation from a high frequency generator, which produces better oxidation reactions. The method, called sonocatalysis, can be used as a third stage polishing operation to clean up wastewater at a theoretical level of total purity. The researchers from Southern Illinois University maintain that their process does a much better job than traditional third stage methods without the necessity of chlorine addition which can react with remaining trace impurities to produce bad taste and odor.

Water and Wastes Engineering, 10(7):22, July 1973.

0243

The multiple-hearth furnace plays a key role in a municipal wastewater treatment system developed by the Envirotech Corp. Lime is regenerated in the furnace from the hydroxides and carbonates formed in lime and soda ash treatment of raw wastewater. The recalcined lime is returned to the influent, and carbon dioxide evolved in the furnace is used in a neutralization step. Designated the Z-M Process, the new method utilizes chemical and physical techniques to provide reusable water without biological treatment. There are three distinct operating zones. The upper hearths form the drying and preheat zone where most free moisture is evaporated. The middle combustion zone is where the material is processed. The lower section of the furnace is the cooling zone where material is cooled prior to discharge. Overflow from the second-stage reactor-clarifier then passes through granular media filters to capture suspended solids which remain after lime treatment and recarbonation. The neutralized wastewater then flows through a carbon adsorber. Small molecules are adsorbed on the surface of the granular activated carbon. After chlorination, the resulting product water may be used for recycle or discharged in compliance with local standards. The activated carbon is regenerated for recycle in a multiple-hearth furnace.

Rock Products, 76(7):62,85-86, July 1973.

0244

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 10 October 1, 1973

Dear Reader:

According to EPA grant specifications, indexing of each item appearing in the *MTB* is being done. The result of this effort will be an annual subject index prepared as part of a Final Report for this project. Also, authors of articles used in preparing the summaries will be indexed alphabetically and a list of journals whose articles are referenced in the publication will be included. It is hoped that these indexes will be printed and ready for distribution in early 1974.

Dorothy A. Sandoski

An investigation demonstrating the importance of proper leaf pickup and control in order to minimize the phosphorus content of urban drainage during the fall of the year has been completed. Oak and poplar leaves were leached with distilled water in laboratory columns to simulate the release of soluble phosphorus forms to urban runoff. Most of the soluble phosphorus leached was reactive in a molybdenum blue analysis. The leaves tested yielded 54-230 μg P/gram of leaves. Consecutive leachings of an oak leaf sample yielded soluble P in amounts related to the effective soaking period between leachings and to the number of preceding leachings. Cut up leaves released almost three times as much soluble P as intact leaves. Leaves collected from the littoral zone of Lake Mendota leached less P than control leaves collected on the shore nearby. The moisture retained on leaves after a rainstorm contained significant soluble reactive phosphorus.

Environmental Science and Technology, 7(9):853-854, September 1973. 6 refs.
0245

A study to develop basic data for providing information on the changes that occur in phosphorus concentration with and without the use of heavy duty detergents has been conducted to measure differences in nutrient concentrations in sewage caused by changes in habits in a selected population of homeowners. Findings indicate that restriction of use of detergents containing phosphorus reduced the phosphorus in raw sewage by approximately 57 percent. Also, the doubling of the BOD and organic carbon concentrations caused primarily by the reduction in sewage flow during the test period would not be expected to occur if other builders were substituted for phosphate compounds; however, the reduction in phosphorus would still occur. In conclusion, arbitrary decisions to remove phosphorus from wastewater either through detergent restrictions or chemical removal appear unreasonable and are based upon minimal scientific evidence.

Public Works, 104(9):126-128, September 1973. 6 refs.
0246

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

A relatively inexpensive, simple, and precise method for the analysis of subnanogram quantities of mercury in natural waters involving the use of wet chemical procedures to preconcentrate the mercury and a "semi-micro" method of analysis based on atomic absorption spectrophotometry is described. Through a combination of a solvent extraction procedure and a "cold-vapor" technique, standard deviations of ± 0.0049 and ± 0.0112 can be obtained at the mean concentrations of 0.023 and 0.166 ng/ml, respectively. Recoveries of 94 percent are reported.

Environmental Letters, 5(3):189-197, 1973. 12 refs.
0247

A rapid and specific method for the determination of low concentrations of methanol over the range 0.5-100 ppm in sewage or other aqueous solutions has been developed. The method involves the use of direct aqueous injection gas chromatography on a porous polymer column. No preconcentration or extraction is required. The analysis time of approximately one minute per sample makes the procedure especially suited to process control applications.

Environmental Science and Technology, 7(9):838-840, September 1973. 8 refs.

0248

The equipment required to provide a small laboratory in up-country areas in developing countries with facilities for five coliform examinations (at 37°C) per day by the five tube 10 ml MPN method is described. The capital cost (excluding installation, buildings etc.) is approximately 120 pounds sterling (U.S. $290) and the running cost per test approximately 3p (U.S. 7 cents).

Water Research, 7(8):1243-1245, August 1973. 5 refs.

0249

A rapid and sensitive method for the separation and isolation of phenols from waters has been developed which uses a column adsorption and desorption procedure prior to the analysis by colorimetry with aminoantipyrine. In comparison with separation by distillation, this method is accurate and precise and agrees well with the widely used distillation procedure. The column procedure is faster and requires less laboratory space than the distillation procedure. A typical analysis of 5 liters of 10 ug/liter phenol requires only 45 minutes. The sensitivity of the method is not dependent on the colorimetry but only on the volume of water analyzed. The column procedure thus allows sub-ug/liter concentrations to be analyzed using conventional colorimetry instead of expensive gas chromatography instrumentation by simply sampling and analyzing greater than 50 liters of water.

Environmental Letters, 5(3):199-207, 1973. 6 refs.

0250

An enzymatic method has been developed for the determination of ammonia-nitrogen, not previously applied in water research. The method is specific for NH_3-N, and the risk of hydrolysis of organic nitrogen compounds is very small, because of near neutral pH and low (room) temperature conditions. Differences between results of enzymatic NH_3-N determination and of a distillation method depended on the type of water. The method has been adapted for application in sediment research, where the exchangeable NH_4-N fraction is determined directly, without an extraction procedure. In comparison with this method, direct distillation of sediment samples gave an overestimation of the NH_4-N content of · 40 percent.

Water Research, 7(8):1129-1136, August 1973. 9 refs.

0251

A convenient method for the determination of arsenic (+3) in natural waters based on a simple modification of the silver dietnyldithiocarbamate "Standard Method" for inorganic arsenic is disclosed. In practice the technique was found to detect an average of 96 percent of the As (+3) present in samples. Less than 1 percent of any As (+5) present was analyzed as As (+3) by the method. The analytical procedure was used successfully to investigate surface waters, groundwater, and simulated reservoir water. In combination with the current "Standard Method", the newly developed procedure allows an easy sorting of the inorganic arsenic in the waters into As (+3), arsenite, and As (+5), arsenate.

Environmental Letters, 5(3):155-164, 1973. 16 refs.

0252

A low-cost data transmission system developed in conjunction with the Devon River Authority, which uses the public telephone network to provide continuous monitoring of river pollution and/or give early flood warnings, has been developed by Delta Controls Ltd., of Kingston-on-Thames. Known as the Deltrol TeleGen system, the solid-state equipment can be used to monitor rainfall and river levels at each of the remote stations to be monitored. Each channel in use is dedicated to a function and scanned and transmitted in order. If a reading needs to be double-checked, it is only necessary to replace the receiver and dial the number again. The memory is not reset if interrogated by accident and because it is continually up-dated, the risk of outside interference is eliminated. Apart from the initial cost of the equipment, the only other expenditure required is a low rental charge for a telephone at the stations.

Control and Instrumentation, 5(7):11, July-August 1973.

0253

MODEL STUDIES

A mathematical model of a conjunctive urban water supply and wastewater system, consisting of the minimization of a concave objective function subject to linear constraints, has been formulated and applied to the City of Los Angeles. The objectives are: to minimize the cost of supplying water from several sources, including the provision for recycling reclaimed water; and, to determine the capacity expansion schedule of the water and wastewater treatment processes. A multi-level solution technique is developed to determine the minimum cost alternative for a selected planning horizon. The first level of the algorithm is an iterative process in which the objective function is successively linearized and a series of linear programs is solved. When this yields no improvement, the second level, a search of neighboring extreme points, is initiated. If there is an improvement at this level, the procedure returns to the first level and continues. The model and solution technique were successfully applied to an actual case and the results can be used as an aid in the comprehensive planning of the system. The mathematical model is flexible in that it can be expanded to include additional water quality constituents, advanced wastewater treatment processes, and variations in water quality standards.

Dissertation Abstracts International, 34(2):697/B, August 1973.

0254

PATENTS

Quantitative determination of toxic substances in natural and wastewater is effected by the introduction of live fish into the water which is circulated to form a current. If there are any toxic substances in the water the fish become unsteady in their movements and are no longer able to swim against the current to maintain their position. This stage is recorded electronically. Any abnormal behavior of the fish carries them against a probe which sets off an advance warning. The mechanical probe is formed from stretched metallic wires in a frame mounted in the test compartment of a tank. When this probe is touched by the fish, mechanical pulses are produced which are converted into electrical pulses by a transformer. These are stored in a memory and a computer calculates the sum of the pulses per unit of time. When this sum exceeds a certain level a signal device is operated.

Belgian Patent 793,346. Applied December 27, 1972. Issued April 16, 1973.

0255

In water purification-filter drainage equipment incorporating a manifold connected to drain tubes, the drain tubes have diaphragms to increase efficiency and are covered on the outside by a layer of reinforced porous concrete. On filtration, the water running up and down through the filter bed through the concrete layer into a perforated tube, passes through the diaphragms and is removed via the manifold through the diaphragms, the tube, and the layer in the reverse order.

Soviet Patent 357,994. Applied March 31, 1971. Issued February 29, 1972.

0256

A water treatment composition which comprises a water soluble chlorine containing compound or blend of compounds, optionally cyanuric acid, a water insoluble fatty diamide synthetic wax, and optionally a molding lubricant, is effective in inhibiting the growth of bacteria, algae, and other plant life in water when the composition is blended together and shaped into dosage unit form. The composition maintains its configuration during exposure to water and retains undesirable insolubles, while permitting the leaching of chlorine from the unit by the action of water upon the composition.

United States Patent 3,753,676. Applied August 18, 1971. Issued August 21, 1973.

0257

Apparatus for rapidly disinfecting a sewage water mixture and separating the solids has been patented by the Diamond Shamrock Corporation. The treatment facility comprises: a chamber having more than one inlet and more than one outlet for liquid effluent; electrolytic disinfecting and solids conveying means disposed in the chamber; and, solids removal means from the chamber.

Swiss Patent 7,206,080. Applied September 6, 1972. Issued April 13, 1973.

0258

Quantitative determination of copper and iron impurities in water present in the form of cyanide complexes and organic compounds involves preliminary decomposition of these compounds by boiling with oxidizing agents and then determining them by known methods. To achieve increased conversion of the impurities into ionic form, a mixture of 30 percent H_2O_2 and concentrated HNO_3 or H_2SO_4 is used as an oxidizing agent. In an example, Fe impurity in water was determined by adding two ml concentrated HNO_3 and one ml 30 percent H_2O_2 solution to a 50 ml sample of the water, boiling for five minutes, and cooling. The volume then was made up to 50 ml with distilled water. 25 ml of the mixture was extracted, its pH adjusted to 3.5, one ml of 10 percent hydroxylamine hydrochloride solution and one ml of 0.5 percent o-phenanthroline solution were added, and the Fe content was determined colorimetrically.

Soviet Patent 358,664. Applied June 10, 1969. Issued January 25, 1973.

0259

An activated sludge sewage treatment process, which comprises mixing influent sewage material with activated sludge to provide a mixed liquor, has been patented by Biospherics Incorporated of Rockville, Maryland. In this process, the mixed liquor is passed to an aeration zone wherein it is aerated to reduce the BOD content thereof and to cause the microorganisms present to take up phosphate. The mixed liquor is then passed to a settling zone containing an anaerobic layer of sludge. In the settling zone, phosphate-enriched sludge, in which the phosphate is present in the cells of the organisms, settles into the anaerobic layer of sludge and a substantially phosphate-free effluent is removed from above the layer of sludge. The sludge is maintained under anaerobic conditions in the sludge layer of the settling zone for a time sufficient to cause the organisms in the sludge to release phosphate to the liquid phase of the sludge. Sludge containing soluble phosphate in the liquid phase thereof is removed from the settling zone. The sludge is then treated to separate a phosphate-enriched aqueous phase and to provide a sludge having a higher concentration of solids and a lesser concentration of phosphate. The concentrated sludge is recycled for mixing with influent sewage material in the activated sludge sewage treatment process.

United States Patent 3,756,946. Applied June 13, 1972. Issued September 4, 1973.

0260

A pipe member has been developed to allow connection to the mains at various angles to the horizontal plane of a drainage unit. The unit has a closed end of reducing diameter which has a side tapping flange contained within its overall diametral dimensions. The pipe member has a reducing closed end with a tapping and flange. The flanged tapping does not exceed the projected diameter of the pipe.

Soviet Patent 358,466. Applied September 15, 1970. Issued December 15, 1972.

0261

SEWER SYSTEMS

Milford, Connecticut has approximately 80 miles of sewer lines which require 13 lift stations to pump sewage over various crests so that gravity flow then can carry it to one of the four treatment plants in the city. Concern over malfunctions or failures at the lift stations encouraged the townspeople to purchase and install an alarm system which provides for fire, flooding, and sludge-caused high water warnings for each plant. The alarm system was purchased piecemeal and installed by local electricians, with minor modifications to meet the needs of the sewage treatment facilities. The entire project, including labor, materials, and consulting fees cost $15,000. Among the advantages of the system are reduced costs by use of public utility lines, major purchase of standard equipment which provides savings over leasing, and the ability of local electricians to repair and maintain the equipment. Also, constant visual surveillance of the entire sewer system is maintained with the ability to expand the status board and alarm system when the sewer system is extended.

Public Works, 104(9):113-114, September 1973.

0262

MATHEMATICAL STUDIES

Mathematics investigating the effect of infiltration or evaporation on groundwater level and on the amount of seepage to or from channels that bound an unconfined

Quantitative determination of copper and iron impurities in water present in the form of cyanide complexes and organic compounds involves preliminary decomposition of these compounds by boiling with oxidizing agents and then determining them by known methods. To achieve increased conversion of the impurities into ionic form, a mixture of 30 percent H_2O_2 and concentrated HNO_3 or H_2SO_4 is used as an oxidizing agent. In an example, Fe impurity in water was determined by adding two ml concentrated HNO_3 and one ml 30 percent H_2O_2 solution to a 50 ml sample of the water, boiling for five minutes, and cooling. The volume then was made up to 50 ml with distilled water. 25 ml of the mixture was extracted, its pH adjusted to 3.5, one ml of 10 percent hydroxylamine hydrochloride solution and one ml of 0.5 percent o-phenanthroline solution were added, and the Fe content was determined colorimetrically.

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Public Works, 104(9):113-114, September 1973.

0262

MATHEMATICAL STUDIES

Mathematics investigating the effect of infiltration or evaporation on groundwater level and on the amount of seepage to or from channels that bound an unconfined aquifer, has been studied for three cases. In the analyses the actual free-surface boundary conditions as well as the exact differential equation were used to obtain the general solution. For the three cases, the rate of seepage was given in mathematical forms as well as in dimensionless curves. A comparison with the solutions based on the Boussinesq equation is presented. These approximate solutions were found to give satisfactory results for shallow aquifers but failed to give reasonably adequate results for relatively thick aquifers. The comparison also indicates that results of these approximate methods deviate greatly from the exact solutions for small values of time.

Water Resources Research, 9(4):1058-1064, August 1973. 5 refs.

0263

STORM WATER CONTROL

Special treatment facilities being tested in Racine, Wisconsin and which are located at points where discharge into a river or stream occurs, may be an alternative to the costly and inconveniencing process of separating combined storm and sanitary sewers. At a cost of $2 million, the new facility has relatively lower capital costs and higher operating costs than Racine's main dry weather wastewater treatment plant, since "satellite plants" operate only about one percent of the time, when overflow conditions take place. The system has a total capacity of 60 mgd and serves over 450 acres of combined sewers. The site chosen for the demonstration project receives discharge from the two largest relief points in the city's interceptor system. Estimates for the cost of separating combined storm and sanitary sewers would run between $10 and $13 million and said separation still would not treat the surface pollution.

Water and Wastes Engineering, 10(8):9, August 1973.

0264

The growing demand for wider streets, parking areas, and other impervious surfaces has raised the question of preservation of natural streams and drainage basins in Bellevue, Washington. With this in mind, the Department of Public Works began investigation of methods to control its urban storm runoff problem. As an experimental approach during the design of a new municipal parking lot, the city decided to install what was nicknamed an "environmental filter system". The purpose of the system is to delay the runoff water in reaching the storm drainage system, reduce the amount of water entering the drainage system, and filter the runoff water. The filter system consists of two primary cross sections; a trench five feet wide and another two feet wide. In both cases, their depth is five feet, determined by the depth to the groundwater table. The section five feet wide receives runoff water from both sides, while the narrower section gets its water from only one side. At the catch basin where the perforated pipe meets the existing storm drainage system, the incoming invert is six inches below the outgoing invert. This forces the perforated pipe to remain partly full after the storm has passed and allows the system to redistribute the stored water back through the trench for maximum seepage into the adjacent soil.

Public Works, 104(9):124-125, September 1973.

0265

GOVERNMENT-SPONSORED REPORTS

A state-of-the-art review of highway deicing practices and associated environmental effects has been conducted. Highlights of the review include the following. The bare pavement policy has resulted in a great increase in the use of deicing salts, in many cases replacing the abrasives previously used. However, no conclusive evidence has been found to substantiate that salt usage makes winter travel safer. Besides chemical melting, various methods for anti-icing/deicing are available or have been conceived which may become more prominent in the future especially when communities realize that a price must be paid to alleviate the environmental effects of wintertime salting. Salt storage facilities often become a major contributing source of local groundwater and surface water contamination and vegetation damage. Coverage and proper drainage of salt piles is becoming more prevalent, but there has not been an adequate acceptance of approved practices and a proper recognition of pollutional problems associated with this material storage. High chloride concentration levels have been found in roadway runoff. The special additives in deicing salts may create more severe pollutional problems than the chloride salts. Many roadside wells, due to contamination by salt laden runoff, have had to be replaced in such snow belt states as New Hampshire, Maine, and Massachusetts. Widespread damage of roadside soils and vegetation has been observed in areas of liberal salt usage. Areas of future research also are indicated in this report.

EPA/ORM Repórt No. EPA-R2-73-257, May 1973. 48 p, 109 refs.

0266

A state-of-the-art review of highway deicing practices and associated environmental effects has been conducted. Highlights of the review include the following. The bare pavement policy has resulted in a great increase in the use of deicing salts, in many cases replacing the abrasives previously used. However, no conclusive evidence has been found to substantiate that salt usage makes winter travel safer. Besides chemical melting, various methods for anti-icing/deicing are available or have been conceived which may become more prominent in the future especially when communities realize that a price must be paid to alleviate the environmental effects of wintertime salting. Salt storage facilities often become a major contributing source of local groundwater and surface water contamination and vegetation damage. Coverage and proper drainage of salt piles is becoming more prevalent, but there has not been an adequate acceptance of approved practices and a proper recognition of pollutional problems associated with this material storage. The feasibility of temporarily detaining storm and combined sewage in natural underground formation has been demonstrated and was to proceed in three phases. Five sites were selected for subsurface geologic and geophysical investigation for the purpose of determining which site possessed subsurface conditions most suitable for storing and retrieving storm and combined sewage. The geophysical work required six resistivity soundings as well as resistivity survey involving five traverses. Based on this work, three sites were selected for four-inch test boring. Two of the sites were too shallow for later demonstration of the technique. The third site was selected for the test pumping of Phase I. Because of the small underground storage available, the City of South St. Paul elected not to continue into Phases II and III. Included in the scope of work for Phase I was an investigation, analysis, and discussion of methods of solids separation which might be used for storm and combined sewage in Phase II and III, prior to injection of the effluent underground.

EPA/ORM Report No. EPA-R2-73-242, Project No. 11030 DSL, Program Element 1B2034, May 1973. 70 p.

0267

Two model open channel configurations (trapezoidal and rectangular) and three water soluble polymers (Polyox Coagulant, Polyox WSR-301, and Separan AP-30) were used to experimentally determine the effects of injecting dilute polymer solutions into open channel water flows. For all test cases, injection of the three polymer additives produced flow characteristic changes reflected as either a water surface level decrease at constant flow rates or a flow rate increase at constant static heads. These flow characteristic changes were found to be dependent, in varying degrees, on channel slope, surface roughness, injection point location, polymer injection method, flow Reynolds number, and injected polymer concentration. In addition, two flumes (Parshall and Leopold-Lagco) and two model side channel spillways (90° V-notch weir and sharp-crested rectangular weir) were used to determine experimentally the effects of polymer additives on the flow measuring characteristics of energy dissipators. It was found that for specific flow systems, the flumes and spillways could be recalibrated for use with polymer/water flows. However, for the Leopold-Lagco flume and sharp-crested weir, as the flow increased, the hydraulic jump inherent to these devices was dissipated by polymer injection, thus preventing further recalibration.

EPA/ORM Report No. EPA-R2-73-238, Contract No. 68-01-0168, Project No. 11020 GQG, June 1973. 74 p, 64 refs.

0268

TREATMENT METHODS AND FACILITIES

The result of a $6000 study on municipal waste control resulted in a concept that uses the existing topography and the soil characteristics of the area to provide advanced treatment at a fraction of the cost of standard primary-secondary-tertiary sewage treatment methods. In cleanup terms, this means a 99 percent purification of the St. Donat, Quebec sewage. Key to the successful implementation of this treatment method is the type and absorption of the soil, which is predominantly sand and gravel. Once the plant is completed, primary treatment will be provided by an existing, but modified, septic tank located above the bay. Settled sewage then passes into the mechanically aerated first lagoon which reduces the pollution load by oxidizing organic matter. The oxidized liquid is pumped to a sprinkler system installed on the peninsula where the existing vegetation and top soil absorbs the greatest part of the organic matter and nutrients. From the peninsula, the water filters through 5 to 35 feet of sandy subsoil, and flows into the second 60-acre lagoon for polishing before emptying into the Ouareau River.

Engineering News-Record, 191(10):14, August 30, 1973.

0269

San Pablo Sanitary District's new $4.4 million treatment plant expansion is providing reliable and efficient treatment for a difficult-to-treat mixture of domestic and industrial wastewater. The main reason for the success of the new plant additions is a two-stage biological treatment plant incorporating the use of a roughing filter prior to conventional activated sludge treatment. The basic concept of this type of treatment plant was to protect the activated sludge portion of the plant from toxic shock loads. This was accomplished by the use of a plastic media roughing filter located between the primary clarifiers and the aeration basins. The performance of the plant, has proven this concept to be an effective means of protecting the bio-mass in the aerator. On several occasions since plant start-up, toxic materials discharged to the sewer have stripped the bio-mass from the filter; however, the activated sludge was unaffected due to protection provided by the roughing filter. The plant is to be developed in two phases. Initially, the facility is to provide for an average wet weather flow of 16.5 mgd. Phase 2 additions will raise the average wet weather treatment capacity to 24.5 mgd.

Public Works, 104(8):89-92, August 1973.

0270

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 11 November 1, 1973

Three of Stockholm, Sweden's four sewage treatment plants are built underground in solid rock due to a lack of surface land. Undergrounding has the advantage of eliminating surface odors, odors that irritate the neighbors and decrease their property values. Land prices in Stockholm prohibit the setting aside of large recreational areas around sewage plants as buffer zones; and, aside from environmental impact, Stockholm residents contend that surface land can be put to better use than for sewage plants. Constructing a sewage treatment in underground bedrock costs from 1.35 to 1.45 times more than a surface facility. An underground plant takes up anywhere from 50 to 100 percent more area than a comparable surface plant since underground tanks cannot be placed immediately adjacent one another and, if the walls of the underground-chamber tanks are to have sufficient strength, they must be about as thick as the tank is wide. Yet certain parts of the plant should be put on the surface: the digestors because of the gas danger, the heating plant, and the buildings for personnel, operations, and workshops. The various tanks in a described sewage treatment process, such as the aeration tanks and the secondary settling tanks, are basically underground rock chambers that have been lined with concrete. The floors and walls of the chambers are lined with a four-inch-thick layer of reinforced concrete and the tunnel roof is sprayed with a waterproof shotcrete. The concrete walls are anchored in the rock with bolts.

Civil Engineering- ASCE, p. 78-83, September 1973.

0271

The current and future water supply system of Zurich, Switzerland and its adjacent communities has been determined. The increasing water consumption by industries and the population has led to a steadily decreasing percentage of drinking water obtainable from spring water and groundwater resources with subsequently increasing importance of surface water bodies as drinking water sources. Adequate water tariffs, closed water cycle in industrial processes, and the exclusive use of reflux coolers are among their basic methods of reducing water consumption. To meet future water needs, the water supply system will be enlarged in the next twenty years by the extension of the Lengg Lake waterworks and the construction of the necessary pipelines, by enlargement of the Zurich water supply system including the construction of groundwater waterworks at Hardhof and of emergency waterworks, and also by the construction of a new lake waterworks complete with pipelines and storage basins at Moos.

Wasser- und Energiewirtschaft, 65(6):211-225, June 1973.

0272

STORM WATER CONTROL

An underground, plastic-encased basin of sand and gravel has been designed and engineered by Karl R. Rohrer Associates, Inc. of Akron, Ohio. The patented "Geo-Cel" concept is intended to give partial treatment and to hold pollutants flushed from combined sewers in the first twenty minutes of a storm. The first such facility is being installed at Akron. The detention basin was constructed by lining a pit with Goodyear's leakproof 30-mil Vinaliner sheeting and filling it with sand and gravel to within three feet of the surface. The gravel was then covered with 10-mil Vinaliner and earth fill placed to original grade. A concrete clarification chamber was built at one side of the detention basin. Storm-flushed material from the combined sewer enters the clarification chamber where chlorine is added and some solids settle out. Wastewater then passes over a weir into the Geo-Cel for storage. When the storm subsides, the

Geo-Cel's contents are returned to the city's sewer system for complete treatment at a municipal plant. Cost is said to be less than one-third that of a conventional treatment facility and the system has a design life of 25 to 40 years.

Public Works, 104(10):116, October 1973.
0273

CONSTRUCTION MATERIALS AND EQUIPMENT

A simple device designed to protect fluid handling equipment, avoid shutdowns, and ensure cleaner products is the basket strainer. Because it has no moving parts to wear out, a basket strainer virtually lasts forever. Basket strainers are installed in liquid lines that require regular or frequent cleaning and hold considerably more material and produce less pressure drop than Y-strainers. Basket strainers, installed upright in a horizontal run of pipe, usually are larger in diameter than the size of the pipeline. For cleaning, the basket is lifted out from the top, a practice especially advantageous when the filled basket is heavy. The efficiency of a basket strainer depends on how well it is matched to the application. Several points, herein detailed, to be investigated prior to selecting a strainer include: ratio of screen area to pipe area, size of strainer openings, basket cleaning requirements, overall size, and materials of construction.

Plant Engineering, 27(19):120-123, September 20, 1973.
0274

The installation of a force main sewer across the Middle Thorofare Channel in Wildwood, New Jersey required less than six hours. The 1320-foot long, 14-inch diameter line now connects Diamond Beach to the area's main sewer. Guard boats stood watch on both approaches to the channel as a wire cable, pulled by a truck-mounted winch hauled the high density polyethylene plastic pipe across the waterway. Concrete collars were placed around the circumference of the pipe to sink it. When the pipe reached its destination on the north bank of the channel, it was filled with water to further aid in the sinking process and settled into an already prepared trench, four feet deep. The flexibility of the pipe permits it to contour to the channel bottom. The entire 1320-foot length of pipe in 40-foot sections was joined in two days by a three-man crew. Joining the sections required from 20 to 25 minutes for each joint of this particular diameter.

Water and Sewage Works, 120(8):54-55, August 1973.
0275

In extending a highway in Paramus, New Jersey, the outfall from part of the drainage system consisted of half-section reinforced concrete pipe. The half-sections were bedded on a 2-foot thick by 8-foot wide cushion of 1.5-inch broken stone, which was shaped to the curvature of the pipe to allow 12-inch stone imbedding. This procedure provided both a satisfactory support for the pipe and its immobility during other construction operations in the vicinity. A reasonable capacity for a section of this size on the slope given is approximately 75 cfs. This would indicate a depth of flow of about 18 inches and provide nine inches of freeboard. Much of the design of the project was performed by Raimondi Engineering Associates of Monroe, New York.

Public Works, 104(10):94, October 1973.
0276

HYDROLOGIC ASPECTS

Presently there exist many procedures and methods for the separation of surface and groundwater runoff by hydrographs; however, their solutions only are applicable for those localities and physicogeographical conditions for which they were derived. The effect of the runoff depths on the accuracy of the rainfall-runoff relationships has been determined using six methods of surface runoff separation with the rainfall-runoff relationships calculated on the basis of the parametric expression of its conditioning factors. From experimentation, the best conditioning factors were found to be: mean casual rainfall values, duration of the casual rainfall, mean relative air moisture ten days prior to casual rainfall, index of preceding rainfall ten days prior to casual rainfall, and index of the preceding discharges expressed as the initial discharge at the point of rise of the flood hydrograph. The results based on the total coefficient of correlation and all other statistical characteristics show that the closeness of rainfall-runoff increases with the increasing number of the conditioning factors up to the six and then remains almost constant. Thus, the differences in the direct runoff determination by separation of the flood hydrograph components as according to particular expressions of rainfall-runoff relationships and their statistical characteristics are not substantial and that differences between mean values of the direct runoff, its standard deviations, and its total coefficients of correlation for the particular methods of the runoff depth determination are negligible on the one percent significance level.

Vodohospodarsky Casopis, 21(3-4):335-350, 1973. 12 refs.

0277

An experimental study on the groundwater drainage flow to a system of horizontal parallel drains bedded in an homogeneous and isotropic porous media has been undertaken. This problem of two-dimensional filtration flow in a vertical plane investigated by the viscous analogue is based on the author's previous work in which the decreasing speed of the depression level vertex point in the midpoint of parallel drain spacing was studied. Thus, the relationship between the monentaneous relative height of this vertex point and the total relative groundwater volume runoff with a decreasing depression level is the herein detailed subject. It is shown that the vertex point drop speed and momentaneous and maximum measuring drainage runoff do not depend on the geometrical shape of the drain but on its filtration active perimeter. The distance of the impermeable layer surface significantly affects the drop speed of the depression level between the drains; and, the closer the drains are bedded to the surface of the impermeable surface the greater is the retarding effect of the impermeable layer surface which then cannot be considered as negligible.

Vodohospodarsky Casopis, 21(3-4):410-436, 1973. 6 refs.

0278

SEWERS

In Toronto, Canada, activities with respect to water pollution abatement are mainly directed towards the upgrading and maintenance of its sewer system and related structures. The City had a thorough study of the problem of combined sewer overflow and established a sewer program in 1965 to convert all combined sewers to road storm and sanitary sewers, with completion projected for sometime prior to the year 2000. The road storm sewer system has been designed so that future total separation can be implemented. With the installation of the road storm sewers, which began in 1966 at an annual average rate of 18 miles, the gradual elimination of the source of pollution associated with overflows is being brought about. Fifteen sewer gage recorders are presently in use for the continuous recording of combined overflows in the waterfront and tributary streams with an additional 13 recorders to be installed by the end of 1973, thus completing the monitoring of the major outfalls in the city. A thorough field investigation program is being implemented to locate, trace, and correct sources of pollution which arise from illegal and erroneous connection of drains and sewers in separated areas, as well as inspections to determine industrial waste infringements. The average cost associated with the investigation of improper cross-connections amounts to $23 per household and the average unit cost for corrective measures totals $650.

Water and Waste Engineering, p. 69, September 1973.

0279

On May 6, 1973, flood waters in the Metropolitan Denver area washed out more than 200 feet of interceptor sewer. This damage required immediate action by the District to protect the public health and welfare and also to protect District facilities. The actual repair work commenced on May 12th and the pipe repair portion of the work was completed and flow returned to the sewer on May 20th. As much of the bolted pipe as was usable (112 feet) was salvaged for replacement and the amount of standard reinforced concrete pipe (120 feet) needed to complete the project was purchased. A reinforced concrete base was first constructed to support the pipe which was placed on the base the following day. A steel reinforced concrete encasement was poured around the pipe. The pipe replacement work and sewer cleaning work were accomplished in accordance with the provisions of a negotiated incentive contract. The actual total cost for the pipe replacement and sewer cleaning work was $34,106.49, well below the original engineers' estimate of $50,000.

Public Works, 104(10):96-96, October 1973.

0280

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

An ultrasonic flowmeter which will directly measure total flow rates in rivers has been developed by the Water Resources Board and the Atomic Energy Research Establishment in Harwell, England. The equipment offers no obstruction to the river flow and operates automatically and continuously. Measurements are made at pre-selected intervals, normally every 15 minutes, and the result is displayed locally in numerical form and then transferred to eight-hole punched paper tape in computer-compatible form. Water level is also measured as part of the sequence by a resistance level gage and again displayed in numerical form; readings are not affected by the condition of the year. The data is then automatically combined with the ultrasonically-determined velocity to compute volumetric flow rate.

Ultrasonics, 11(5):195-196, September 1973.

0281

A procedure for the simultaneous determination of Cu^{+2}, Pb^{+2}, Cd^{+2}, and Zn^{+2} ions in city water which has been retained in the water pipes for 24 to 72 hours has been developed. The ions are electrodeposited on a Balanced Head Stationary Hanging Mercury Drop Electrode (BHMDE) at -1.5 volt *vs.* Hg pool for a period of five minutes with stirring at 300 rpm in 0.5 *M* sodium acetate and 0.1 *M* potassium tartrate supporting medium. The relationship between the dissolution peak currents and pre-electrolysis potential, the effects of foreign cations on Cd and Pb, and the effects of the surface active substance on the dissolution currents of Cu, Pb, Cd, and Zn were examined. A good linear relationship as obtained by the standard addition method was observed between the concentrations of ions and the wave heights in the range of 0.5×10^{-7} *M* to 5×10^{-7} *M*.

Bunseki Kagaku, 22(6):763-770, June 1973.
13 refs.

0282

A systematic comparison of all important criteria for the selection of either scandium-46 or iridium-192 as the radioisotopic glass tracer for bed-load transport studies in rivers and estuaries has been attempted. This study was restricted to only these two tracers as they are found to be the only strong contenders for long-range quantitative studies. Results indicate that except for the transport problem, Sc-46 appears preferable to Ir-192 in all other aspects, particularly with regard to the production of the inactive tracer and field measurements. Further the use of Sc-46 provides higher detection sensitivity with less effect on the response due to variations in the bed-detector distance.

Journal of Hydrology, 19:189-204, 1973.
8 refs.

0283

A modified asbestos mat-fiber glass filter method is presented for the analysis of suspended solids in wastewater process streams. A comparative evaluation was made among this method, the conventional asbestos mat, and the fiber glass disk methods. From the standpoint of analytical performance, the three mats compared favorably in terms of precision of measurement and showed good reproducibility. In all of the solids determination, the individual results from each sample were within ten percent of the combined mean for all three types of filter media. The combination mat tends to distribute particles throughout the asbestos fiber and prevent them from clogging as with the fiber glass disk. With the asbestos mat method, the required filtration period is generally about three times as long as that necessary with a combination mat. Thus, it appears that the use of a combination filter mat will facilitate considerably more rapid analysis for suspended solids with no apparent loss of analytic accuracy.

Journal of the Water Pollution Control Federation, 45(9):1853-1858, September 1973. 3 refs.

0284

GOVERNMENT–SPONSORED REPORTS

A brief review of the characteristics of storm and combined sewer flows is given followed by a general discussion of the purposes for and requirements of a sampling program. The desirable characteristics of automatic sampling equipment are set forth and problem areas outlined. A compendium of over 60 models of commercially available and custom designed automatic samplers is given with descriptions and characterizations of each unit presented along with an evaluation of its suitability for a storm and/or combined sewer application. A review of field experience with automatic sampling equipment is given. A technical assessment of the state-of-the-art in automatic sampler technology is presented. Design guides for development of a new, improved automatic sampler for use in storm and combined sewers are included.

EPA/ORM Report No. EPA-R2-73-261, Contract No. 68-03-0155, June 1973. 233 p, 29 refs.

0285

PATENTS

A sewage treatment and cooling system has been patented by Cherne Industrial, Inc. The system includes a sewage treatment conduit in which liquid sewage is conveyed along an extended continuous loop or recirculating path, with means for introducing additional sewage at least at one point along the conduit, and with means for feeding at least a portion of the liquid from the conduit through the cooling condensers of an operating plant and back into the sewage treatment conduit. Propulsion and treating means are included for maintaining at least a minimum rate of flow in the conduit to prevent settling of solids and for aerating the liquid. A plant cooling system pumping means preferably serves as one propulsion means for moving the liquid along through the conduit. Liquid in the conduit is aerated both for cooling it to the degree required for reuse in the cooling system and for oxygen enrichment to promote the desired sewage treatment. Liquid is removed from the sewage treatment conduit to settling tanks at a rate substantially equal to the rate of incoming flow of sewage less evaporation and other losses.

United States Patent 3,760,946. Applied March 31, 1971. Issued September 25, 1973.

0286

A water pollution monitoring system which may be coupled with data handling and processing equipment has been patented. Varying levels of pollutants are detented by means of a variety of sensors and an electrical signal corresponding to the pollutant level is processed for recording and/or transmission. Means are provided for automatic periodic cleaning of the sensors so that a high level of accuracy can be maintained for an extended period of time. Additional means are provided for data reduction within the system to reduce massive volumes of detected information to that which is specifically of interest to the equipment operator. Still further means are provided for controlled suspension of the system in aqueous media to maximize system operation.

United States Patent 3,762,214. Applied May 21, 1971. Issued October 2, 1973.

0287

A patent has been assigned to L. M. Crampton for a system of treating sewage in which the sewage passes a grinder to reduce the solids and then goes into a holding tank underground. The sewage flows from the holding tank to an evaporator with the products of combustion flowing over water heating coils and under the holding tank to heat the sewage water and to preheat the holding tank. Condensate from the products of combustion flows to a holding tank and from there into the ground with the gaseous material passing off through a stack.

United States Patent 3,762,549. Applied July 2, 1971. Issued October 2, 1973.

0288

Apparatus and method for the electrolytic treatment of sewage is disclosed. According to the method, electrolytic treatment of a stream in a sewage treatment plant is provided at one or more selected locations. The apparatus employed includes one or more electrolytic assemblies using anodes formed by a coating of lead dioxide on a substrate of graphite or titanium and a hollow, cylindrical metal tube which forms the cathode. Electrolyte flows through the assembly from an inlet conduit near the bottom to an outlet conduit near the top, and electrical connections are made to the exterior cathode can and to a portion of the anode substrate which protrudes from the top of the assembly.

United States Patent 3,764,500. Applied October 28, 1970. Issued October 9, 1973.

0289

MODEL STUDIES

A model has been developed with the objective of utilizing the total storage capacity available in the system in such a manner as to minimize the water pollution resulting from overflows at individual points within the system. In addition, it is required that no abrupt changes in control be admitted, as this is likely to lead to undesirable surges. The nonlinear model is shown to fit within the framework of an optimal regulator problem with derivative constraints. The optimal feedback control law is derived and compared with the optimal bang-bang controller. The solution technique that is presented may be applied to many combined storm-sewer systems in which the flows through the systems to the treatment plants may be controlled. It may be used by city engineers to determine necessary modifications to existing systems in order to meet the new standards regarding water pollution.

IEEE Transactions on Systems, Man, and Cybernetics, SMC-3(5):450-455, September 1973. 9 refs.

0290

TREATMENT METHODS AND FACILITIES

Expansion and modernization of two wastewater plants is helping Milwaukee, Wisconsin protect the waters of Lake Michigan. Unique features at the Jones Island plant include fine and coarse screening in lieu of primary settling basins, the use of waste pickle liquor for effective phosphorus removal at almost negligible cost, and sludge disposal by production of commercially-marketed fertilizer under the well-known name, Milorganite. Included in the modernization project is utilization of waste heat from the generators to aid in the drying process in the Milorganite production. The South Shore plant capacity is rated at 120 mgd but provisions have been made to accommodate three times this flow through the treatment process with bypassing of sewage into the lake. The aeration basins are designed for conventional and step aeration, the final settling basins are octagonal in shape, plant units are arranged to provide for any quarter of the plant to be isolated and operated independently in times of storm flow or for experimental purposes, and chlorination of the effluent is effected in the outfall conduit with the necessary detention time being provided in the 132-inch pipeline extending approximately 2000 feet into Lake Michigan to a water depth of 25 feet.

Water and Wastes Engineering, 10(9):64-67, September 1973.

0291

The aim of a novel wastewater-cleanup system, called Pressure Pipe Treatment (PPT) and developed at the Irvine Ranch Water District in California, is to clean wastewater by activated sludge treatment while conveying it long distances. PPT eliminates the need for a conventional secondary treatment plant because the bacterial process takes place in a pipeline while the wastewater is transported from homes and businesses to the point of reuse. Much of the usual primary treatment equipment also is not required. The initial operation in the process puts raw sewage through a high-rate screening unit to separate solids. The solids are ground and sent to an aerobic sludge activator, which begins the activated sludge process. Activated sludge is then combined with the liquid portion of the sewage in the pipeline and oxygen is injected not only at the start of the pipeline, but also at several points en route. The sludge-free water is meanwhile treated in a sand filter for additional suspended solids removal. PPT is expected to utilize nearly 100 percent of the oxygen supplied and requires one hour residence time for pipeline treatment; relatively short pipe-runs are possible.

Chemical Engineering, 80(22):32, 34, October 1, 1973.

0292

The largest aerobic biochemical fermentation tank ever produced in the world, based on the Kanegafuchi Chemical Industries' research, has been developed in Japan. The Kaneka-type Deep Aeration Tank has a fast oxygen supply method while maintaining high efficiency. This high oxygen dispersion rate is possible since the depth of the liquid in this tank is much greater than the commonly accepted pool-type aeration tank. The greater depth of the tank decreases the necessary space to one-fourth or one-fifth of previous pool-type tanks. Also, the activated sludge process employing this tank has an excellent aeration result since the waste liquid flowing into the aeration tank is immediately dispersed into the sludge and BOD concentration is distributed evenly. The system is ideal for treatment of waste liquids with high BOD concentrations, such as those produced by marine product processing, various fermentation processes, food, milk, and dairy product processing, beverage manufacturing, city sewage, and other organic liquid wastes.

Report prepared by the Kanegafuchi Chemical Industries Co., Ltd., 5 p, 1973.

0293

A two-million-dollar advanced wastewater treatment plant at Rosemount, Minnesota is nearing completion under the supervision of the Sewer Board System. The plant is designed for a 600,000-gpd average capacity with sizable expansion possible. Raw sewage enters the plant through a one-inch bar screen that removes large objects and trash. After flowing by gravity through a common flume into a wet well, the sewage is divided into two separate treatment trains. The first process component in each train is an Ecodyne Reactivator clarifier which uses lime to precipitate phosphates as calcium phosphate. After clarifier retention of four hours, effluent pH is lowered from 11 to 8.5 before entering four ecodyne Graver Monoscour filters (two filters handle each section of the stream). The dual media filters reduce inorganic and organic suspended solids to 3-5 ppm in filtered effluent. After filtration, the effluent is pumped to a filtered water holding tank that regulates any surges occurring in the system. From the holding tank, water is pumped to six carbon adsorption tanks, three on each stream, for removal of dissolved organics. The effluent then enters a secondary set of four Ecodyne Monoscour filters to remove fine solids, flows to another holding tank and then into an ion exchange vessel for ammonia removal. Effluent from the ion exchange system, the last treatment step, is discharged from the plant with less than one ppm ammonia nitrogen.

Environmental Science and Technology, 7(9):804-805, September 1973.

0294

An automatic antifoam feed system in which the system senses changing demand for antifoam and adjusts the chemical feed rate has been developed for use with aeration basins. The heart of this foam probe system is a sensing electrode that detects the level of foam by conductivity. The sensing electrode is installed in the foaming system at the maximum desired foam height. The foam probe system operates by feeding a small amount of antifoam continuously from a base load pump and additional antifoam from an automatically controlled surge pump. The surge pump is activated only when foam touches the foam sensing electrode.

Water and Sewage Works, 120(8):56-57, August 1973.

0295

Note:

Due to a printing error in the October issue of *MTB*, item 0267 has been corrected to read as follows:

The feasibility of temporarily detaining storm and combined sewage in natural underground formation has been demonstrated and was to proceed in three phases. Five sites were selected for subsurface geologic and geophysical investigation for the purpose of determining which site possessed subsurface conditions most suitable for storing and retrieving storm and combined sewage. The geophysical work required six resistivity soundings as well as a resistivity survey involving five traverses. Based on this work, three sites were selected for four-inch test boring. Two of the sites were too shallow for later demonstration of the technique. The third site was selected for the test pumping of Phase I. Because of limited underground storage availability the City of South St. Paul elected not to continue with Phases II and III. Included in the scope of work for Phase I was an investigation, analysis, and discussion of methods of solids separation which might be used for storm and combined sewage in Phase II and III, prior to injection of the effluent underground.

EPA/ORM Report No. EPA-R2-73-242, Project No. 11030 DSL, Program Element 182034, May 1973. 70 p.

0267

MUNICIPAL TECHNOLOGY BULLETIN

Volume 1, Number 12
December 1, 1973

CONTRUCTION EQUIPMENT AND MATERIALS

A new drainage system in the low lying sections of Luna Pier, Michigan is partially completed resulting in storm overflow disappearance within two hours. It used to remain in the streets for days! The key to the new system is two single-pit pumping stations. Each contains a pair of Flygt Corp. submersible pumps rated at 2500 gpm per unit. Pump controls, mounted in a weather-tight panel above ground at each station, are programmed to operate the pumps on alternate cycles. Liquid level sensors, also supplied by Flygt Corp., control pump operation. Also, a change in the cross-section of street pavements, constructed with a valley or swale in the center, in those areas subject to flooding allowed the use of only one catch basin at each intersection (instead of four) and only one sewer line running along the center of the street.

The American City, 88(9):116-117, September 1973.

0296

A new slide-away sewage pump coupling has reduced periodic maintenance check downtime at the Mansfield, Ohio Sewage Treatment Plant from several hours to about thirty minutes. The time saving is due to the coupling's combination of stationary and movable coupling faces that can be disconnected in minutes as opposed to hours in conventional sewage ejector installations. The Peabody Barnes coupling automatically guides the pump into operating position when it is lowered into the pit. With this new installation, using a one-ton block and tackle, a two-man maintenance team can lift the pump, clean it, and drop it back into position; it is no longer necessary to drain the pit or unbolt the pump from its connections.

Water and Wastes Engineering, 10(10):44, October 1973.

0297

MODEL STUDIES

The cost of sewerage systems constitute a major fraction of the overall cost of wastewater disposal. Optimal design of such systems can be approached by employing dynamic programming. A procedure by which the optimal design can be obtained has been developed, but is not practical at the present time due to limitations in computer space and computation time. An alternative, more restrictive, procedure has been proposed by which a suboptimal design can be obtained at a reasonable computation effort. This optimization procedure has been applied to small sewerage networks, both hypothetical and real, where its usefulness was clearly demonstrated. Large sewerage systems may be decomposed to smaller subsystems, which are optimized internally, and later recombined to a single optimal network. Development of more advanced computers may render the procedure applicable for obtaining the absolute optimal design of large networks.

Journal of the Environmental Engineering Division, ASCE, 99(EE5):703-716, October 1973. 7 refs.

0298

Model rainfall for the dimensioning of mixed sewer systems has been derived from time analyses of heavy rainfalls in Prague, Pilsen, and Brno to obtain the loading of the sewer system due to rainfall preceding the main period of precipitation. Rainfall with an initial peak period occurring within the first half of the total duration was predominant; rainfalls with uniform and non-uniform intensity distributions were found to be of equal frequency. The rainfall profile, composed of three sections, includes: that of the initial rainfall period with 25 percent of the average intensity of the precipitation period and of the same duration as the latter; a second phase of the precipitation period; and, a final rainfall period.

Gas- und Wasserfach, Wasser/Abwasser, 114(9):435-440, 1973. 7 refs.

0299

The effects of operating a plant with a constant sludge-wastage rate and with a constant concentration of mixed-liquor solids have been investigated by computer simulations. From a theoretical point of view, if any sewage parameter is not completely stable then a slightly better quality effluent is likely to be achieved when the plant is operated with a constant specific wastage rate. In practice, however, the slight improvement is not likely to be measurable. The effects of a sudden stable increase or a slug dose of sewage substrate and bacterial content on the plants operated in the above two ways have been simulated together with diurnal variations in sewage flow, and in concentrations of bacteria, debris, and substrate in the sewage.

Water Research, 7(10):1439-1452, 1973. 2 refs.

0300

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

A continuous method of monitoring water quality by chlorination consumption under ultraviolet radiation has been developed and examinations performed on aqueous solutions of 51 compounds and raw water at a purification plant. Combination of chlorine and ultraviolet light permits far more rapid consumption of chlorine for various organic compounds than in the case of mere contact of chlorine and organic compounds without light. However, it may be a defect of this method that acetic acid does not consume chlorine even under irradiation. Values obtained for two groups were rather complicated as compared with COD; however, rough differentiation between these two groups of compounds would be possible. The proportionality and additivity of chlorine consumption data in mixed solutions were obtained only in low substrate concentrations. As the photosensitizers in this method, mercury and lead salts were found effective.

Tokyo Kogyo Shikenjo Hokoku, 68(7):257-265, July 1973. 9 refs.

0301

Laser Raman spectroscopy has been used to detect a salt of a herbicide, 2,4-dichlorophenoxy acetic acid, in water solution at concentrations as low as 500 ppm. In this experiment, all spectra were excited with a 50 mW He-Ne gas laser at 6328 angstroms. Lower concentrations should be detectable with a more powerful laser at higher frequency. The Raman spectrum of the powder was substantially different from the spectrum of the pollutant in aqueous solution. The spectrum of the potassium and sodium salts were the same for the powder or aqueous solution. Five strong bands exist in aqueous solution, and four of these bands are detectable at concentrations as low as 500 ppm. The resonance Raman effect is discussed as a possible method for the detection and identification of small optimal concentrations of pollutant in water.

Water Research, 7(10):1417-1429, 1973. 9 refs.

0302

A dual beam colorimeter system has been designed and developed to meet specific requirements of the Upper Tame Main Drainage Authority for routine and continuous monitoring. An instrument, capable of electronically processing the output signal from the colorimeter and printing out the results in concentration terms, was created for the system. The operation of this instrument, manufactured by Servicon Dynamics, Ltd., can be separated into the following four sections: the input amplifiers, linearizer, and subtractor; tha analog to digital conversion and the maximum memory system; the digital output stage; and, the power supplies. Analyses of chemical oxygen demand as well as ammoniacal and oxidized nitrogen determinations, using the automatic printout double beam colorimeter, agree closely with manual COD results, yet chemical reactions for the latter determinations must be watched more closely for temperature control and potential oxidation.

Process Biochemistry, 8(9):15-17, September 1973. 3 refs.

0303

As demands for better water quality have increased, the need has grown for a convenient and reliable method of measuring down to 0.01-0.05 mg Fe/liter. This determination, herein developed, was confined to absorptiometric methods as most water laboratories have the necessary instrumentation. A literature survey indicated that the chromogenic reagent 2,4,6-tri-(2'-pyridyl)-1,3,5-triazin (TPTZ) was suitable; optimum conditions for the use of this reagent were established and the performance of the resulting method determined. Advantages of this method include: good precision derived from the use of TPTZ; performance is rapid and simple; and, substances commonly found in raw and treated waters cause no serious interference.

Water Treatment and Examination, 22(2):100-113, 1973. 15 refs.

0304

An improved method using potassium dichromate for the determination of the chemical oxygen demand of groundwater and surface water samples has been developed. In this process, the water sample to be tested is combined with one gram of mercury sulfate per 50 ml of water, after which 50 ml of chromosulfuric acid are added. The flask then is thermostatized at 140°C for four hours. The test solution is cooled to room temperature, diluted with bidistilled water, combined with two to three drops of ferroin solution, and finally titrated with a standard solution of ammonium-ferrous sulfate until the color shifts from yellow-green across blue-green to reddish brown. The method is suitable from COD determinations within the range of 0.5-200 mg of oxygen per liter.

Gas- und Wasserfach, Wasser/Abwasser, 114(8):366-370, 1973. 14 refs.

0305

SEWER SYSTEMS

Renovation of sewer lines and manholes cut infiltration 1.1 mgd at peak loading in a Georgia community. In early 1971, the sewage treatment at St. Simons Island was being subjected to peak loadings of more than two mgd by groundwater infiltration through leaking collector lines and deteriorated manholes and catch basins. Work was begun in March 1971 with Southern Line crews assigned to clean, televise, and repair more than six miles of sewage collection lines and renovate 62 deteriorated manholes, the latter accomplished by the use of special cement formulas and techniques developed by Southern Line research. Since project completion, hydraulic loading on the treatment facility has diminished from peak values of over two million gpd to values peaking at 900,000 gpd. Also, sand infiltration has noticeably been decreased as indicated by grit chamber loading. According to current design criteria, an additional 2000 customers can be added to yield a maximum loading hydraulically of 1.5 mgd. This would mean a prospect of doubling the present loading which could result in a minimum increase in revenue of $9500 per month in accord with their present rate structure.

Water and Wastes Engineering, 10(10):47, October 1973.

0306

HYDROLOGIC ASPECTS

Sewage was diverted from Lake Sammamish in September 1968, and since then there have been no significant responses by trophic indicators which indicate the lake is beginning to recover. To explain this delay in response, extensive urban development in the lake's watershed was considered as a factor which might be acting to inhibit the lake's recovery. *In vitro* unialgal experiments with water from 13 streams which drain urban and underdeveloped areas showed that about half of the streams stimulated algal growth significantly, but these streams constitute less than 14 percent of the lake's total water income. *In situ* experiments showed that no streams were significantly stimulatory to natural populations of phytoplankton. Other *in situ* studies showed that one urban stream and two from undeveloped areas caused substantial increases in periphyton growth after a 12-day period, although these increases were not statistically significant. Results do not support the contention that urban runoff is seriously enriching the limnetic region of Lake Sammamish.

Water Research, 7(10):1505-1516, 1973. 15 refs.

0307

The influence of local precipitation quantity on the loading of mixed water bodies was studied partly on the basis of systematic pluviographic measurements conducted in Ingoldtadt, Munich, and Mittenwald. Increases in the quantity, duration, and frequency of the loading, composed of surface storm runoff, deposits in sewers, and dry-weather runoff, with increasing precipitation quantity were observed. Results indicate a rapid increase in the rate of pollutant deposition with increasing deposition time. Also, for high critical precipitation quantities over 10 liters per second, climatic factors had little effect on overflows caused by storm water over extended periods of time.

Berichte der Abwassertechnischen Vereinigung, (26):163-172, 1973. 5 refs.

0308

A recurrence analysis technique using probability and contingency relationships of snow depth, water equivalent, and snow density is presented. Three methods of estimating snow water parameters at site A by recurrence and the presently used regression techniques are based on (1) the value from the previous month at site A, (2) the value from a reference site, and (3) the month to previous month contingency parameter of the reference course. The recurrence technique, Pearson type 3, when it was tested on three central Idaho snow courses was most useful when method 3 was used to estimate snow depth and either method 1 or 3 was used to estimate the water equivalent. Correlation of estimated values to measured values indicated equal reliability of recurrence and regression analysis when the three methods were used. The recurrence technique can be used successfully in estimating snow water parameters and their probability of occurrence.

Water Resources Research, 9(5):1433-1439, October 1973. 5 refs.

0309

A method has been developed for estimating climatic expectancies of flood or drought from the mean and variance of a precipitation record. An interrelationship between the distributions of amounts from the various observing periods is demonstrated so that any one of these records may be used to estimate the others. The method is based on the cube root normal distribution of precipitation and on an observed tendency for the distrubtion lines to be parallel. The relationship between monthly, daily, and so forth amounts must be derived in some manner from the frequency spectrum of precipitation rates. This spectrum is shown to have the same profile as the theoretical spectrum for atmospheric pressure; thus the $E(f) \sim f^{-5/3}$ spectrum of kinetic energy regulates the relationship between precipitation distributions.

Water Resources Research, 9(5):1235-1241, October 1973. 10 refs.

0310

PATENTS

This invention is designed to improve errors in the previous method of measuring ammonia nitrogen residue in liquid using a Nessler reagent and comparing the color of Millon's base with the standard colors of nitrogen solution. Since other substances and color material are dissolved in the test liquid, this measurement method often caused errors. In the new method, an excess but given amount of Nessler reagent is added to the sample liquid and the entire ammonia nitrogen residue in the liquid is made to react. The remaining Nessler reagent concentration is measured by polarography, and thus the concentration of nitrogen residue is indirectly obtained. In using this method, if the nitrogen concentration range is narrow, the Nessler additive may be in a small quantity; however, if the concentration range is broad, the amount of reagent must be large. The reliability of the method is excellent.

Japanese Patent Sho 48-11200. Applied October 9, 1969. Issued April 11, 1973.

0311

A method and apparatus for creating a flow of aqueous waste periodically which will eliminate from sewers and manholes any settled solids accumulated therein has been patented by the FMC Corporation of San Jose, California. The system consists of a sewage accumulation tank positioned in a manhole and communicating with the liquid sump thereof at a level below that of the outlet sewer conduit. The tank is adapted with vacuum means to induce flow of sewage into the accumulation tank and means for introducing air into the tank to eliminate the vacuum and to release the accumulated sewage rapidly to join with the normal sewage flow to produce a flushing surge of liquid flowing in the sewer conduit.

Canadian Patent 934,636. Applied August 5, 1971. Issued October 2, 1973.

0312

Sealing of sewer pipe connections can be accomplished by placing the sealing ring onto the sleeve of one pipe end which is to be inserted in the complementary end of another pipe. The sealing ring is gradually moved into its final position while being radially compressed at the same time.

German Patent 2,122,638. Applied May 7, 1971. Issued August 16, 1973.

0313

GOVERNMENT–SPONSORED REPORTS

A hydraulic laboratory pilot project was run in conjunction with mathematical modeling to refine and demonstrate the swirl flow regulator/solids-liquid separator. The device, of simple annular shape construction, requires no moving parts. It provides a dual function, regulating flow by a central circular weir while simultaneously treating combined wastewater by a 'swirl' action which imparts liquid-solids separation. The low-flow concentrate is diverted via a bottom orifice to the sanitary sewerage system for subsequent treatment at the municipal works, and the relatively clear liquid overflows the weir into a central downshaft and receives further treatment or is discharged to the stream. The device is capable of functioning efficiently over a wide range of combined sewer overflow rates, and can effectively separate suspended matter at a small fraction of the detention time required for conventional sedimentation or flotation. For these reasons, serious thought is being given to the use of swirl units in series and in parallel solely as wet-weather (and domestic sewage) treatment plant systems.

EPA/ORD Report No. EPA-670/2-73-059, September 1973. 49 p., 13 refs. Paper Presented at the 45th Annual Meeting of the New York Water Pollution Control Association, New York, New York, January 22, 1973.

0314

TREATMENT METHODS AND SYSTEMS

A method of removing poisonous heavy metals from sewage by using coal is being developed at the University of British Columbia in Canada. In this system, sewage passes over a bed of low-grade lignite coal which attracts heavy metals such as lead, zinc, copper, chromium, cadmium, and mercury. In this way, almost 100 percent clearance of these metals has been achieved. It is estimated that the whole sewage flow of Iona Island, Vancouver which contains 70 million gallons a day could be treated with coal. This would require 700 tons of low-grade coal, crushed into ¼-inch particles and spread in an 8-inch thick bed over an area of more than an acre. Such a bed could be used efficiently for at least 200 days. Its cleaning properties could then be restored by washing with a weak solution of nitric acid which would dissolve the metals attracted by the coal.

Materials Reclamation Weekly, 123(11):21, September 15, 1973.

0315

Recent expansion of the Sacramento, California main wastewater treatment facility added a secondary stage including increased headworks capacity, biological filters, secondary clarifiers, and the latest types of automatic control instrumentation. New instrumentation includes Vutronik solid-state electric miniature indicator controllers in the sludge-handling control room and Vutronik recorders in the main control room. All instrumentation was furnished by Honeywell to Fred J. Early, Jr. general contractor for the main plant expansion program. The Early firm subcontracted to Honeywell for supervision services during installation and commissioning of the control systems.

Instrumentation, 26(2):7-11, 1973.

0316

Various methods of biological denitrogenation of urban sewage were investigated by laboratory experiments and a pilot plant between November 1971 and February 1973, with application to treatment of urban sewage being firmly ascertained. The Wuhrmann method, the Bringmann method, and the new process developed by Ludzack and Ettinger were examined. Results indicate that the Bringmann method leaves some unnitrated NH$_3$ and N in sewage. Therefore, the mixed liquid in the nitration tank was fed to the first denitrogenation tank where urban sewage was contacted and completely denitrogenized. The liquid then was fed into the nitration tank and remaining NH$_3$-N oxidized. Finally the liquid passed into the secondary denitrogenation tank where the Wuhrmann method was applied. The elimination rate of nitrogen was found to be more than 90 percent without a methanol additive. This new method appears particularly effective in the area of organic waste liquid treatment.

Yosui to Haisui, 15(9):26-42, September 1973. 26 refs.

0317

The City of Pensacola, Florida has all but eliminated the possibility of resorting to partial treatment in the case of power failure or equipment downtime. Under the jurisdiction of the Sewage Treatment Division are five treatment plants and 63 pumping stations scattered around the franchised area. These five plants have a total capacity of 10.5 mgd. At the Central Plant, which treats about 9.0 mgd of the total volume, treatment is by the activated sludge method which yields a better than 90 percent reduction in BOD. City planners took steps to make certain that treatment would continue under almost all conditions. First primary power for each of the three 10,000 cfm mechanical blowers is a Caterpillar natural-gas engine. Second, at full plant capacity, something less than two of these engines are necessary for complete treatment. Pensacola installed three engines; one of which is always on standby. In addition, two 5000 cfm electric blowers were installed last year. To keep necessary electric gear functioning in case of an outage, a 190 kw Caterpillar standby generator was installed with the natural gas engines. The total effect of the treatment process has been to reduce BOD by at least 90 percent from an input strength of between 200 and 360 mg/liter making the effluent to Pensacola Bay within the safe level. Also, the solids content of the input waste, about 0.1 percent, has been separated and concentrated to the three percent level of the digested sludge.

Water and Sewage Works, 120(9):120-121, September 1973.

0318

When the new Gainesville, Florida water plant goes on-line next year, it will be one of the most automated 40 mgd lime-soda softening operations in existence. Telemetry will monitor all plant functions, while a computer will control the water treatment processes. The computer also will tie into the present telemetry of the city's water distribution system. Treatment will consist of lime-soda softening with two, 85-foot diameter Eimco solids contact reactor clarifiers. Two submersible-combustion Ozark-Mahoning recarbonators, using natural gas, will stabilize the clarified water. The plant will have four filters, each processing 10 mgd at a 5 gpm/ft^2 filtration rate. The Turbatrol mixed media filters will use granular anthracite and sand over a Leopold filter underdrain bottom. Turbidity monitoring at the media interface and of the effluent will be provided as well as loss of head indicators for backwash control. Backwash will be started manually by the operator with automatic sequencing thereafter. Filtered water will be controlled in an 875,000-gallon capacity clear well for transfer to two 5-million-gallon capacity ground storage reservoirs. A 500,000-gallon capacity wash water tank will provide a nearly constant head during the backwash cycle using the plant's Peerless pumps.

The American City, 88(9):92-94, September 1973.

0319

Dear Reader:

As you are aware, space is occasionally unfilled at the end of an issue (due to the availability of pertinent articles appearing in the literature). In an attempt to use this space effectively, we are including notices prepared by the EPA-Project Officer of meetings, workshops, idea sessions, and the like, to keep you informed of Government activities. These notices will appear when time and space allows.

Dee Dee Sandoski

Notice #1

Users of EPA's Storm Water Management Model (SWMM) have recently formed a User's Group. The SWMM, a comprehensive mathematical model of urban runoff phenomena, is extremely useful for investigating storm and combined sewer overflow pollution abatement alternatives in planning and design. The SWMM User's Group meets every 4-6 months and serves as a forum for the exchange of information and applications between users. Information about the group and its activities, and about SWMM itself, may be obtained from:

Harry C. Torno
Municipal Pollution Control Division
Environmental Protection Agency
Office of Research and Development
Washington, D. C. 20460

Notice #2

Representatives from EPA participated together with participants from 15 other countries in the "International Workshop - Instrumentation, Control and Automation for Wastewater Treatment Systems" in London and Paris in September. The preprints, containing approximately 65 papers, is the equivalent of a comprehensive state-of-the-art report. A limited number are available at a cost of $7.50 plus handling from:

Dr. S. H. Jenkins
Executive Editor - Water Research
Upper Tame Main Drainage Authority
% Tame Valley House
156-170 Newhall Street
Birmingham, England.

The final printed proceedings will be available in approximately one year from the International Association on Water Pollution Research.

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